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TERRESTRIAL SEDIMENT TRANSPORT INTO THE MARINE ENVIRONMENT OF CANADA: ANNOTATED BIBLIOGRAPHY AND DATA

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IWD-HQ-WRB-SS-86-1

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TABLE OF CONTENTS

	PAGE
ABSTRACT	II
RESUME	II
INTRODUCTION	III
LIST OF REFERENCES	VI
REFERENCES AND ABSTRACTS	1
APPENDIX 1 - DATA TABLES	
APPENDIX 2 - MAP OF DATA SITES	

ABSTRACT

This report consists of a compilation of reference material pertaining to sediment transport into the marine environment of Canada. It is divided into three sections: 1) references and abstracts, 2) tables showing Water Survey of Canada data and data contained in specific studies and 3) a map showing the sites with available data.

RESUME

Ce rapport est un catalogue de références concernant le transport de sédiments à l'environnement marin du Canada. Il est divisé en trois sections: 1) références et résumés, 2) tableaux illustrant les données compilées par la division des relevés hydrologiques du Canada et celles contenues dans des études particulières et 3) une carte indiquant la localisation des sites étudiés.

INTRODUCTION

This report presents a compilation of reference material and data on terrestrial sediment transport into the marine environment. These data and references refer to suspended sediment and bedload transport only.

The report is organized as follows:

1. An alphabetical list by author showing reference title and report page number.

2. List of references, abstracts and data alphabetically by author (85 in total).

   In addition to the author, title and source, an abstract or summary is provided. This latter material is either copied directly from the reference or compiled by the authors of this report.

   Each reference is completed by a data statement which is categorized as primary (original data is presented), secondary (use of already published data; a reference to the original source is given) and tertiary (generalized data from various sources). Where necessary data have been converted to metric units.

3. Tables of available data which are organized by coastal area starting with the Atlantic, followed by the Arctic and then the Pacific coast. For each coastal area, the data are subdivided into data from Water Survey of Canada publications (only suspended sediment) and then data from specific studies.

   For the Water Survey of Canada data, information is provided for province, station name and number, drainage area, years of record, number of days sampled, mean annual discharge, mean annual concentration, total annual load and annual basin yield. Where possible, mean and standard deviation are presented for the last four parameters. Finally the body of water the river flows into is identified.

   A different format is provided for the specific studies tables. Information is provided for the province, reference by author, river, study year and data (when available) on suspended sediment concentration range, bedload, total load and basin yield. The body of water into which the river flows is also identified.

   The Water Survey of Canada and specific studies data are presented by coastal area, but are numbered sequentially starting from the Atlantic coast.

4. Finally, a map showing the location of each river listed in the tables is presented at the back of the report. The rivers are identified by the number shown for each site on the left hand column of the tables.

The report has been designed for the reader to start with the map number, then going to the tables to obtain the specific data. The source of the data can then be found and subsequently located in the alphabetic reference list.

Data sources included in this report refer to only those sites where the river flows directly into marine waters, except for the tributaries to the St. Lawrence River, and the Iskut River in British Columbia. Where several sources exist for the same river, the site closest to the coast was chosen.

The authors realize that they have probably not been exhaustive in this compilation and would therefore appreciate receiving additional references and data.

LIST OF REFERENCES

PAGE	AUTHOR	TITLE
1	Amos, C.L.	Effect of Tidal Power Structures on Sediment Transport and Loading in the Bay of Fundy - Gulf of Maine System.
1	Amos, C.L. Joice, G.H.E.	The Sediment Budget of the Minas Basin, Bay of Fundy, N.S.
3	Amos, C.L. Long, B.F.N.	The Sedimentary Character of the Minas Basin, Bay of Fundy.
3	d'Anglejan, B.F.	Preliminary Observations on Suspended Matter in the Gulf of St. Lawrence.
3	d'Anglejan, B.F.	Effects of Seasonal Changes on the Sedimentary Regime of a Subarctic Estuary.
4	d'Anglejan, B.F.	Patterns of Recent Sedimentation in the Eastmain Estuary, Prior to River Cut-off.
5	d'Anglejan, B.F. Smith, E.C.	Distribution, Transport and Composition of Suspended Matter in the St. Lawrence Estuary.
5	Atlantic Tidal Power Engineering and Management Committee	Report to Atlantic Tidal Power Programming Board on the Feasibility of Tidal Power Development in the Bay of Fundy.
6	Aubin, L. Caron, D. Tran Van, T.	Hydrologie et sédimentologie du territoire de de la Baie James.
6	B.C. Hydro	Stikine-Iskut Hydroelectric Development. Feasibility Study. Hydrology, River Regime and Morphology.
8	B.C. Hydro	Stikine-Iskut Hydroelectric Development. Hydrology, River Regime and Morphology.
9	B.C. Hydro	Stikine-Iskut Development. Interim Preliminary Design. Reservoir Sedimentation and Suspended Sediment Balance.
9	Ballantyne, C.K.	Geomorphological and Hydrological Investigations in a High Arctic Drainage Basin.
10	Bornhold, B.D.	Suspended Matter in the Southern Beaufort Sea.
11	Bray, D.I. DeMerchant, D.P. Sullivan, D.L.	Some Hydrotechnical Problems Related to the Construction of a Causeway in the Estuary of the Petitcodiac River, New Brunswick.

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11	Brunskill, G.J.	Sediment Yield from Tributaries to the Mackenzie River, N.W.T., Canada.
12	Brunskill, G.J. Rosenberg, D.M. Snow, N.B. Vascotto, G.L. Wagemann, R.	Ecological Studies of Aquatic Systems in the Mackenzie-Porcupine Drainages in Relation to Proposed Pipeline and Highway Developments.
13	Camotim, D. Frenette, M.	Evolution morphologique des estuaires des estuaires des rivières Romaine et Saint-Jean.
14	Canada, Department of Transport	Sediment Discharge of Les Grèves and Chenal aux Corbeaux Sections.
14	Canada, Department of Transport.	Sediment Discharge at Les Grèves Section.
15	Cataliotti-Valdina, D. Long, B.F.	Evolution du débit liquide et de la charge solide d'un estuaire sub-boréal; rivière St. Jean, Québec (côte nord du Golfe du St-Laurent).
16	Cataliotti-Valdina, D. Long, B.F.	Evolution estuarine d'une rivière régularisée en climat sub-boréal: la rivière aux Outardes (côte nord du Golfe du St-Laurent, Québec).
17	Centreau	Etude du fleuve St-Laurent, tronçon Varennes-Montmagny.
17	Church, M.	Baffin Island Sandurs: A Study of Arctic Fluvial Processes.
18	Church, M. Ryder, J.M.	Paraglacial Sedimentation: A Consideration of Fluvial Processes Conditioned by Glaciation.
19	Cluis, D. Couillard, D. Lapointe, R. Potvin, L. Rousseau, A. Sasseville, J.L. Tessier, A.	Etude du Fleuve St-Laurent (tronçon Varennes-Montmagny): Synthèses des études 1973-1974).
19	Couillard, D.	Géologie et géochimie du fleuve de l'estuaire du Golfe St-Laurent (Canada).
20	Davies, K.F.	Mackenzie River Input to the Beaufort Sea.

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20	Environment Canada	Historical Sediment Data Summary Canadian Rivers to 1978.
21	Environment Canada	Sediment Data Reference Index Canada 1982.
21	Environment Canada	Sediment Data Canadian Rivers 1983.
22	Farrow, G.E. Syvitski, J.P.M. Tunnicliffe, V.	Suspended Particulate Loading on the Microbenthos in a Highly Turbid Fjord: Knight Inlet, British Columbia.
23	Forbes, D.L.	Babbage River Delta and Lagoon: Hydrology and Sedimentology of an Arctic Estuarine System.
25	Forbes, D.L.	Morphology and Sedimentology of a Sinuous Gravel-Bed Channel System: Lower Babbage River, Yukon Coastal Plain, Canada.
26	Frenette, M.	Aspects physiques, hydrauliques et morphosédimentologiques des rivières Nottaway, Broadback et Rupert 1977.
26	Frenette, M.	Aménagement hydroélectrique des rivières Nottaway, Broadback, Rupert.
27	Frenette, M. Larinier, M.	Some Results of the Sediment Regime of the St. Lawrence River.
27	Gilbert, R.	Observations on Oceanography and Sedimentation at Pangnirtung Fiord, Baffin Island.
28	Hardy Associates (1978) Ltd.	Alluvial Sedimentation of the Mackenzie River System.
28	Harper, J.R. Penland, S.	Beaufort Sea Sediment Dynamics.
29	Holeman, J.N.	The Sediment Yield of Major Rivers of the World.
30	Hoos, L.M. Packman, G.A.	The Fraser River Estuary - Status of Environmental knowledge to 1974.
30	Johnston, W.A.	Sedimentation of the Fraser River Delta.
30	Kellerhals, R.	Review of Sediment Survey Program - Lower Fraser River, British Columbia.
31	Kidd, G.J.A.	Fraser River Suspended Sediment Survey.

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31	King, W.A.	The Geomorphological and Sedimentology of the Lower Reaches of the Attawapiskat River, James Bay, Ontario.
32	King, W.A. Martini, I.P.	Morphology and Recent Sediments of the Lower Anastomosing Reaches of the Attawapiskat River, James Bay, Ontario.
33	Knight, R.J.	Sediments, Bedforms and Hydraulics in a Macrotidal Environment, Cobequid Bay (Bay of Fundy) Nova Scotia.
34	Kranck, K. Ruffman, A.	Sedimentation in James Bay.
35	Langley, H.I.	An Experiment in Bedload Sampling by Pumping.
36	Langley, H.I.	Bedload Sampling by Pumping.
36	Legendre, L. d'Anglejan, B.F.	Etudes sédimentologique et géochimiques de la Baie de Rupert entre 1976 et 1977.
36	Lewis, C.P. Forbes, D.L.	Sediments and Sedimentary Processes, Yukon Beaufort Sea Coast.
37	Lisitzin, A.P.	Sedimentation in the World Ocean.
37	Long, B.F. Bouchard, D. Dumas, J.P.	Etude des variations de la charge solide du fleuve St-Laurent entre Trois-Rivières et Gentilly, Québec.
38	Long, B.F. Morissette, M. Lebel, J.	Etude du matériel particulaire en suspension et du matériel dissous des rivières Romaine et St. Jean durant un cycle saisonnier.
39	Luternauer, J.L.	Genesis of Morphologic Features on the Western Delta Front of the Fraser River, British Columbia - Status of Knowledge.
40	Macdonald, R.W.	The Distribution and Dynamics of Suspended Particles in the Kitimat Fjord System.
40	Mathews, W.H. Shepard, F.P.	Sedimentation of Fraser River Delta, British Columbia.
41	McCrea, J.H.	Study of the Petitcodiac River Estuary.
41	McDonald, B.C. Lewis, C.P.	Geomorphic and Sedimentologic Processes of Rivers and Coast, Yukon Coastal Plain.

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42	McLaren, P.	River and Suspended Sediment Discharge into Byam Channel, Queen Elizabeth Island, N.W.T., Canada.
42	Meade, R.H. Parker, R.S.	Sediment in Rivers of the United States.
43	Milliman, J.D.	Sedimentation in the Fraser River and its Estuary, South Western, British Columbia, Canada.
43	Milliman, J.D. Meade, R.H.	World-wide Delivery of River Sediment to the Oceans.
44	Neill, C.R. Mollard, J.D.	Examples of Erosion and Sedimentation Along Some Northern Canadian Rivers.
44	Østrem, G. Bridge, C.W. Rannie, W.F.	Glacio-Hydrology, Discharge and Sediment Transport in the Decade Glacier Area, Baffin Island, N.W.T.
45	Pretious, E.S.	The Sediment Load of the Lower Fraser River, B.C.
45	Pretious, E.S.	Downstream Sedimentation Effects of Dams on Fraser River, British Columbia.
46	St-Pierre, S. Messier, D.	Bilan sédimentaire des rivières Eastmain et Opinaca et évaluation de l'influence des seuils sur le transport sédimentaire.
46	Stichling, W.	Sediment Loads in Canadian Rivers.
47	Sundby, B.	Distribution and Transport of Sediment Particulate Matter in the Gulf of St. Lawrence.
48	Syvitski, J.P.M. Farrow, G.E.	Structures and Processes in Bay Head Deltas: Knight and Bute Inlet, British Columbia.
48	Tamburi, A.J.	Sediment and Morphological Studies of the Lower Fraser River.
49	Thomas, D.J. Macdonald, R.W. Cornford, A.B.	Geochemical Mass-Balance Calculations for the Coastal Beaufort Sea, N.W.T., Canada.
50	Tywoniuk, N.	Sediment Budget of the Lower Fraser River.

PAGE	AUTHOR	TITLE
51	Tywoniuk, N. Stichling, W.	Sedimentation Phenomenon of the Fraser River.
52	Wedel, J.H. Thorne, G.A. Baracos, P.C.	Site-Intensive Hydrologic Study of a Small Catchment on Bathurst Island.
57	Western Canada Hydraulic Laboratories Ltd.	Analysis of Lower Fraser River Sediment Data.
57	Western Canada Hydraulic Laboratories Ltd.	Analysis of Federal Sediment Survey Data Taken on the Lower Fraser River.
58	Winters, G.V.	Environmental Geology of the Miramichi Estuary: Suspended-Sediment Transport.
58	Winters, G.V.	Modelling Suspended Sediment Dynamics of the Miramichi Estuary, New Brunswick, Canada.
59	Zrymiak, P. Durette, Y.J.	An Investigation of the Morphological Processes Occurring in the Squamish River Estuary.

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AMOS, C.L.
1976: Effect of Tidal Power Structures on Sediment Transport and Loading in the Bay of Fundy - Gulf of Maine System; IN: Fundy Tidal Power and the Environment. Proceedings of a Workshop on the Environmental Implications of Fundy Tidal Power, Wolfville, Nova Scotia, November 4-5, 1976, G. Daborn, Editor, Acadia University Press, Vol. 28, p. 233-254.

ABSTRACT:

This paper provides the results of a preliminary study of the origins, transport patterns and deposition sites of Minas Basin sediments in conjunction with a monitoring program of a man-made structure considered analogous to a tidal barrage scheme. The results show that the majority of material introduced into the Minas Basin is derived from eroding cliffs by wave action and that the material is mostly sand-size and moves as bedload within the intertidal zone. The volume of material ($3.0 \times 10^6 m^3$) derived from cliff erosion in the Minas Basin is sufficient to cause the total siltation of an area extending from a tidal barrage (situated between Economy Point and Cape Tenny) to a point 600 m seaward, in 20 years. This tidal barrage would be situated directly across the transport path of $4 \times 10^6 m^3$/year of sediment derived from cliff erosion and open sea supply.

DATA:

The discharge of sediment from the Herbert River into the Avon estuary has been calculated on data collected over a six month monitoring period. The average sediment discharge is 0.5 tonnes/day, rising to 20 tonnes/day and greater during periods of high rainfall. This provides a total contribution of 650 tonnes of suspended particulate matter to the Minas Basin each year. Approximately 60% of this volume is supplied during nearly 20 days of high runoff.

AMOS, C.L. and JOICE, G.H.E.
1977: The sediment budget of the Minas Basin, Bay of Fundy, N.S.; Report, Bedford Institute of Oceanography, Data Series BI-D-77-3, 411 p.

ABSTRACT:

This research work has resulted from the need to answer the question "what will be the nature and magnitude of siltation which may result from the construction of a proposed tidal power barrage scheme in the Bay of Fundy"?

The results presented in this report are a data base on the origins, transport paths and deposition sites of sediments within the Minas Basin; a region of potential tidal power development. The first part of this report deals with the sediment budget of the system, comparing the volumes of sediment derived from the various sources and comparing them to the removal of sediment from the system.

The results indicate that there is sufficient sediment, retained within the Minas Basin, to create siltation problems in the vicinity of a tidal power scheme under the right sedimentation conditions, and that the supply of sediment should remain constant, even after barrage construction. The evolution of the Minas Basin was examined by reference to geophysical data, and from coring of the superficial sediments. In this manner, an assessment of the conditions of deposition over the last 10,000 years could be made indicating the probable nature of the Minas Basin sediment budget during the past. It appears that the supplies and transport of sediment within the Minas Basin system have been increasing over the last 10,000 years, and may still be increasing.

The transport of sediment, both as bed load and in suspension has, and is, being studied, to relate the sites of origin of the sediments to regions of sediment deposition. During this time, data on the processes considered to be controlling the movement of sediment were also collected. Results indicate that one site of potential tidal power development occurs directly across the transport path of sediments moving from their sources to the ultimate sites of deposition.

The nature of siltation expected to take place in the vicinity of a tidal power barrage may well have similarities to sedimentation resulting from presently existing intertidal constructions. A study of the deposits associated with Windsor causeway, in the Avon river estuary, showed that a major portion of the sediments available have been deposited in the vicinity of the construction, also that the effects of the causeway appear significant more than 20 km from the site of the causeway.

Finally, the results of this report were collected and presented to be of use in the development of mathematically predictive models which may offer more detailed results of the expected post-constructional sedimentation. Also these results may help substantiate or disprove many of the basic assumptions contingent to the development of the predictive models.

DATA:

HERBERT RIVER SEDIMENT DISCHARGE

(i) Spring/Summer Sediment Discharge - 1 May 76 - 31 July 76

Maximum Discharge	56.03 tonnes/day
Mean Discharge	1.64 tonnes/day
Total Discharge	151.43 tonnes

(ii) Summer/Autumn Sediment Discharge - 25 Sept. 75 - 31 Dec. 75

Maximum Discharge	117.72 tonnes/day
Mean Discharge	2.67 tonnes/day
Total Discharge	261.70 tonnes

NOTE: DATA BASED ON DIRECT OBSERVATIONS.

AMOS, C.L. and LONG, B.F.N.
1980: The Sedimentary Character of the Minas Basin, Bay of Fundy; IN: The Coastline of Canada, S.B. McCann, Editor, Geological Survey of Canada, Paper 80-10, p. 123-152.

ABSTRACT:

An analysis of the present sediment character and distribution, and sediment budgets and transport conditions was made. The various physical processes that affect these features were measured. The materials are derived mainly from cliffs bordering Minas Basin. They are well mixed within the water column. Most of the material within the intertidal zone is sand whereas the subtidal zone comprises glacial marine silts overlain by postglacial marine sediments. The study indicates a steady increase in the supply of material since 6300 B.P.

DATA:

Secondary Source; refer to AMOS (1976) and Water Survey of Canada Data.

D'ANGLEJAN, B.F.
1969: Preliminary Observations on Suspended Matter in the Gulf of St. Lawrence; Maritime Sediments, Vol. 5, No. 1, p. 15-18.

ABSTRACT:

The observations provided in this paper indicate the ranges in suspended-sediment concentrations and show the role played by the estuarine-type circulation in regulating the exchange between the Gulf of St. Lawrence and the open ocean.

DATA:

The outward inorganic transport above the 400 metre level is approximately 4.1×10^3 tonnes/day based on samples taken during surveys in 1967 and 1968. The mean annual suspended sediment load (Gulf of St-Lawrence at Cabot Strait) is 1.0×10^6 tonnes.

D'ANGLEJAN, B.F.
1980: Effects of Seasonal Changes on the Sedimentary Regime of a Subarctic Estuary; Rupert Bay, Canada; Sedimentary Geology, Vol. 26, p. 51-68.

ABSTRACT:

Rupert Bay is a large (875 km^2) shallow estuarine embayment opening in James Bay south of Hudson Bay, Canada. Three large rivers with a combined annual mean discharge of 2 350 m^3/sec converge into the bay. Due to ice unloading and crustal readjustment, at a current rate of 1 m/100 years, these rivers have excavated their channels into marine sediments of the early post-glacial Tyrrell Sea invasion. These provide the main source of the poorly sorted silty clays forming the present deposits.

Sediment transport and deposition are influenced by strong seasonal fluctuations in climate, with a continuous ice cover for nearly six months of the year, a rapid break-up and spring discharges which are as much as sixteen times the yearly minima.

During the open season, high turbidity prevails with a pronounced streakiness in the flow direction and stable fronts at the boundaries of the river plumes. Both the turbulence by local wind waves and tidal action hinder deposition. Determination of the suspended load and velocity at tidal stations indicate that conditions are met for seaward tidal flushing of the sediments brought in by the rivers. Under ice-covered conditions, there is a pronounced decrease of the suspended-matter concentrations in the reduced volume of the bay, suggesting that settling occurs below the ice cover, the winter deposits being largely returned to the water column in the following spring.

Low present depositional rates are confirmed by measurements of the ^{137}Cs activity in the surface deposits. On a longer-term basis, crustal rebound maintains a slight regional uplift which forms entrenchment of the river channels as well as slow progradation of the supratidal marshes.

DATA:

Secondary Source; refer to Frenette (1977).

D'ANGLEJAN, B.F.
1982: Patterns of Recent Sedimentation in the Eastmain Estuary, Prior to River Cut-Off; Naturaliste Canadien, Vol. 109, No. 2, p. 363-374.

ABSTRACT:

The estuary of the Eastmain, the second largest river in terms of annual discharge on the Quebec side of James Bay, covers an area of approximately 16 km^2. A survey by gravity coring shows that inside the river channel, the early post-glacial Tyrell Sea deposits lie below less than 30 cm of coarse sands and gravels. Reflection seismic profiling indicates that the average thickness of post-glacial marine and lacustrine sediments does not exceed 15 m over a glacial till surface or the Archean basement. Within and just outside the channel entrance, the sediments are laminated with a varve-like textural regularity, while further offshore, in the region of James Bay affected by the river plume, they show irregular color banding. These laminations and color bands, which contrast in texture and organic matter content between dark and light units, appear to reflect seasonal changes in sediment output from the river. Under natural conditions, this was more than 1×10^6 tons annually.

DATA:

During the 1976 field season, the maximum measured suspended solid flux was approximately 50 600 tonnes/day on May 8 with a minimum on April 4

of 93 tonnes/day. Peak suspended concentrations averaged over the stream cross-sections at the measurement site exceeded 250 mg/L on May 8, and values of 6 mg/L were recorded on April 20. The weighted mean, yearly sediment load introduced into the Eastmain estuary in 1976 was about 1.2×10^6 tonnes.

NOTE: These results are based on an Internal Report of the Société D'Energie de la Baie James, 1976.

D'ANGLEJAN, B.F. and SMITH, E.C.
1973: Distribution, Transport and Composition of Suspended Matter in the St. Lawrence Estuary; Canadian Journal of Earth Sciences, Vol. 10, No. 9, p. 1380-1396.

ABSTRACT:

The distribution of total suspended matter in the estuary of the St. Lawrence River was studied by quantitative filtration through membrane filters. Tidal fluctuations in the vertical gradients of suspensoids were followed at fixed stations along the estuary. The concentrations varied from nearly 40 mg/L below near Ile d'Orléans, to values less than 1 mg/L at the downstream end of the upper estuary near the Saguenay River entrance. The tidal mean concentrations for the fixed stations ranged from 20 mg/L to 2 mg/L. A turbidity maximum, which develops because of entrapments of particles by the tidal circulation, extends for 100 km below Quebec City. In this zone large vertical gradients changing in intensity with the tide by resuspension of settled material exist above the bottom. The total suspended matter is 60% to more than 90% inorganic by weight, and has a mean particle size between 5 and 7 μ. The annual rate of transport of suspended material out of the upper estuary at a section near the Saguenay River is estimated at less than 1×10^6 metric tons.

Chemical and mineralogical analyses were performed on 23 suspensoid samples collected by centrifuging large volumes of water. The clay mineral composition of the less than 2 μ fraction is on the average 1.5% montmorillonite, 8% kaolinite, 31% chlorite, and 60% illite. However, large time and space variations are found both in the chemistry and mineralogy of the suspended matter.

DATA:

Suspended-sediment load to the lower estuary and the Gulf of St. Lawrence = 0.5 to 0.6×10^6 tonnes/year based on tide-averaged mean concentrations of suspensoids in the water column measured at two fixed stations upstream of the Saguenay River.

ATLANTIC TIDAL POWER ENGINEERING AND MANAGEMENT COMMITTEE
1969: Report to Atlantic Tidal Power Programming Board on the Feasibility of Tidal Power Development in the Bay of Fundy. Halifax, Nova Scotia, Appendix 3, Ice and Sediments, 38 p. + 10 Tables and 25 plates.

ABSTRACT:

This appendix discusses ice formation and movement in those areas of the Bay of Fundy associated with the tidal power developments investigated. In addition, it deals with sediment in its many aspects which are of importance to the reliable operation, low-cost maintenance and long economic life of a tidal power development.

DATA:

Secondary Source; refer to Water Survey of Canada Data.

AUBIN, L., CARON, D. and TRAN VAN, T.
1976: Hydrologie et sédimentologie du Territoire de la Baie James; IN: James Bay - Environment, Proceeding of the Symposium, 19-20 May, 1976, Société de développement de la Baie James et Société d'énergie de la Baie James, p. 421-444.

ABSTRACT:

Thanks to the operation of an hydrometric station network which has been installed progressively since 1960, the hydrology of the James Bay Territory is fairly well known.

This exposé illustrates the condition of the hydrometric networks and emphasizes the main characteristics of the flow, more particularly the time and space distribution of alluvial deposits. Spring risings are given a special attention, mainly in terms of their variability and contribution to the total annual flow.

Knowledge on the sedimentological regime of rivers on the Territory acquired as a result of periodic measurements by the Department of Natural Resources has been increased thanks to measurements taken by the SEBJ during the year 1974; data collected on La Grande Rivière are used to explain the regime of rivers.

DATA:

Secondary Source; refer to Water Survey of Canada Data and Services des eaux de surface du Québec.

B.C. HYDRO
1981: Stikine-Iskut Hydroelectric Development. Feasibility Study. Hydrology, River Regime and Morphology; Report No. H1110, Hydroelectric Generation Project Division, 100 p. + Appendices.

ABSTRACT:

The Hydrology, River Regime and Morphology Studies of the Stikine-Iskut Development described in this report were carried out for two major reasons. Firstly, to provide information for use in the project feasibility study and secondly, to provide information for the environmental impact analysis.

Field and office studies were carried out to provide preliminary estimates for each proposed project of long-term flow patterns, flood frequencies, probable maximum floods and useful reservoir life.

Field and office studies were also carried out to provide preliminary estimates of the regulated flow regime, channel morphology changes and water temperature changes that would result from the construction of the project.

The significant findings of these studies are listed below:

1. The following tabulation highlights the important hydrologic features for economic and design considerations.

Site	Average Annual Flow (m^3/s)	15-year Return Period Flood (m^3/s)	PMF Peak Inflow (m^3/s)	Spillway Design Discharge (m^3/s)	Useful Reservoir Life (Years)
Site Z	286.5	2 440	9 175	7 645	2 200
Tanzilla	291.8	2 480	7 645	7 645	-
Iskut Canyon	251.4	1 630	6 286	5 680	180
More Creek	69.4	500	2 676	1 580	1 600

2. The river reaches downstream of the project sites will likely be affected by changes in flow regime, channel morphology and water temperature.

The flow changes on both rivers are likely to result in a reduction of approximately 50 percent in summer flows and an increase ranging from 300 to 500 percent in winter flows at the major project sites. Near the mouth of the Stikine at the USGS gauge the approximate effect on flows is likely to be a 25 percent reduction in summer flows and a 100 percent increase in winter flows. This would translate into a .8 m decrease in summer water level and a .8 m increase in the winter levels. The downstream braided sections of the Iskut would probable become less braided as side channels silt up and the main channel widens and deepens. A similar process would occur on the Stikine but to a much lesser extent. The downstream water temperatures resulting from the proposed regulation would probable be cooler in summer and warmer in winter.

This report was prepared largely during 1980 on the basis of the data available at that time (basically up to the end of 1979, except for snow course data, the latest of which was dated April 1980). An extensive field data collection program has been established which will provide additional data for environmental, design and operational studies as required during the preliminary design stage of the development. It is intended that addendum reports be prepared in the future at such intervals as the additional data warrant.

DATA:

Measuring Station	Total Suspended-Sediment Load - April to September (tonnes)		Estimated Annual Load (tonnes)	
	1978	1979	1978	1979
a) Iskut River below Johnson River	4 885 000	4 261 000	8 562 000	6 364 000
b) Stikine River above Butterfly Creek	2 265 000	5 945 000	2 435 000	6 355 000
Sum of a and b	7 150 000	10 206 000	10 997 000	12 719 000

These estimates are calculated from rating curves based on measured concentrations.

NOTE: Also Refer to B.C. Hydro Data and Water Survey of Canada Data.

B.C. HYDRO
1982: Stikine-Iskut Hydroelectric Development. Hydrology, River Regime and Morphology; Addendum Report on Suspended Sediment. Report No. H1463, Hydroelectric Generation Project Division, July 1982.

ABSTRACT:

This report is a supplement to the final report (H1110).

It incorporates data collected in 1980 and 1981 which were not presented in the main report.

DATA:

MEASURING STATION	ESTIMATED ANNUAL LOAD (TONNES)				LONG TERM ANNUAL LOAD ESTIMATES
	1978	1979	1980	1981	(TONNES)
a) Iskut River Below Johnson River	7 053 000	5 443 000	8 838 000	11 774 000	7 208 000
b) Stikine River Above Butterfly Creek	2 423 000	5 294 000	8 312 000	8 315 000	5 468 000
c) Sum of a and b	9 476 000	10 737 000	17 150 000	20 089 000	12 676 000

These estimates are calculated from rating curves based on measured concentrations.

NOTE: Also refer to B.C. Hydro Data and Water Survey of Canada Data.

B.C. HYDRO
1983: Stikine-Iskut Development. Interim Preliminary Design. Reservoir Sedimentation and Suspended Sediment Balance; Report No. H1664, Hydroelectric Projects Division, Development Department, 21 p. + Appendices.

ABSTRACT:

A 5-year program (1978-1982) of suspended sediment data collection has been carried out on the Stikine and Iskut rivers in both British Columbia and Alaska. Data has been collected at or near the proposed project locations and at downstream points.

It is estimated that the volume of sediment trapped by the proposed reservoirs would equal the volume of the reservoirs at the minimum storage level in approximately the following times:

Stikine Canyon	1900 years	
More Creek	730 years	
Iskut Canyon	140 years	(assuming More Creek Project in place)
Forrest Kerr	34 years	

The Tanzilla reservoir would not receive significant quantities of suspended sediment until Stikine Canyon reservoir filled with sediment. The rapid loss of storage in the Forrest Kerr diversion would not impair its primary function of diverting water to the More Creek reservoir.

Sediment loads at points downstream from the projects will be reduced. The Stikine Canyon project would reduce the suspended sediment load at the Stikine River estuary by about 8 percent while the Iskut project would reduce the sediment load at the estuary by about 21 percent.

DATA:

Secondary Source; refer to B.C. Hydro (1981; 1982).

BALLANTYNE, C.K.
1975: Geomorphological and Hydrological Investigations in a High Arctic Drainage Basin; Unpublished M.Sc. Thesis, McMaster University, Hamilton, 233 p.

ABSTRACT:

This dissertation reports the results of investigations into the geomorphic role of fluvial processes in a high-arctic glacierized drainage basin in the summer of 1974. A review of the relevant

literature (Chapter 1) is followed by a statement of objectives and a description of the study area. In Chapter 3 the drainage network at the time of deglaciation is reconstructed and the subsequent modifications effected by the river are shown to involve downcutting concomitant with isostatic recovery, with the resultant formation of gorges and terracing of alluvial deposits. The three-month hydrologic regime of the river and its major tributaries is described and analysed in Chapter 4. Glacial meltwater is found to constitute 55% of total discharge, snowmelt 35%. Flash floods occurring on the river are explained in terms of the temporary retardation of flow at the glacier margin. In Chapter 5, figures for dissolved and suspended concentrations and load are presented for the river and its major tributaries, and sediment concentration - discharge relationships are described and discussed. Sources of sediment are investigated and results compared with those obtained elsewhere in the arctic. Chapter 6 includes a description of the erosional landforms of the basin, and a detailed analysis of cobble-size distribution over the surface of active and relict sandar from which it is concluded that cross-sandur variations in clast size may be just as significant as downsandur fining. The major conclusions of the study are restated in the final chapter.

DATA:

The total suspended sediment load of the Schei River during 1974 was calculated at 10 251 tonnes based on a rating curve from 67 samples.

BORNHOLD, B.D.
1975: Suspended Matter in the Southern Beaufort Sea; Beaufort Sea Technical Report #25b, 23 p.

SUMMARY:

Concentrations of suspended matter measured in the southern Beaufort Sea in August and September, 1975 ranged from less than 0.1 mg/L to more than 17 mg/L. The highest concentrations were recorded at nearshore stations off Kugmallit Bay. Mid-water and near-bottom zones of turbid water are common, though their exact causes are not clear.

The distributional pattern of suspended matter reflects closely the physical oceanography of the area. As seen from satellite photographs, the sediment plume from the Mackenzie River is carried eastwards along the inner shelf while the plume emanating from Kugmallit Bay remains as a distinct band of turbid water along the southwestern Tuktoyaktuk Peninsula. The small basin southeast of Herschel Island receives considerable suspended sediment from longshore drift produced by a small clockwise eddy and the easterly flow past Herschel Island. The anticlockwise gyre which flows south and southeastward into Mackenzie Bay, brings little suspended matter into the shelf waters west of Herschel Island.

The major components of the suspended matter include fine inorganic particles, organic aggregates of plankton and inorganic particles, and phytoplankton. Throughout the area the clay minerals display distinct

differences. The Mackenzie Bay and outer shelf samples contain montmorillonite, kaolinite and little chlorite and inshore samples off Kugmallit Bay contain no kaolinite or montmorillonite and abundant chlorite.

DATA:

Tertiary Source; refer to Lisitzin (1972).

BRAY, D.I., DeMERCHANT, D.P. and SULLIVAN, D.L.
1982: Some Hydrotechnical Problems Related to the Construction of a Causeway in the Estuary of the Petitcodiac River, New Brunswick; Canadian Journal of Civil Engineering, Vol. 9, No. 2, p. 296-307.

ABSTRACT:

In 1968 about 21 km of the upper end of the Petitcodiac River estuary was cut off as a result of the construction of a causeway, the associated control structures, and a fish passage facility. The primary purposes of these engineering works are to provide a highway link across the estuary and to protect upstream agricultural lands from flooding during periods of high tides.

Some of the practical problems that have occurred in the Petitcodiac River estuary as a result of the construction of the causeway are presented in this paper. These problems include: major geomorphological changes, annual changes in bed level near the causeway, beach formation upstream of the causeway, and net upstream transport of sediment through the fishway at the control structure.

No detailed analytical solutions are presented due to the expense of extensive data collection and the difficulty of formulating adequate models for such physical systems. However, examples are given to show that limited field data and observations may be used to provide order-of-magnitude estimates of anticipated changes and to develop an understanding of the dominant processes that are active in such an environment.

DATA:

Secondary Source; refer to McCrea (1975) and Water Survey of Canada Data.

BRUNSKILL, G.J.
1974: Sediment Yield from Tributaries to the Mackenzie River, N.W.T., Canada; Geological Society of America, Abstracts with Programs, Vol. 6, No. 7, p. 1025-1026.

ABSTRACT:

Rates of transport of suspended sediments from selected tributaries of the Mackenzie River varied from 0.017 metric tonnes $km^{-2}yr^{-1}$ (low relief watersheds containing many lakes) to over 100 tonnes

$km^{-2}yr^{-1}$ (high relief watersheds draining the Mackenzie Mountains). The magnitudes of discharge and relief appear to be controlling factors on sediment yield in this region. Approximately 160 x 10^6 tonnes of suspended sediment are delivered to the Mackenzie Delta annually by the Mackenzie and Peel Rivers. The clay-sized sediments are largely illite, chlorite, and amorphous clays, with small proportions of kaolinite and montmorillonite. Cation exchange capacities are low, ranging from 8 to 15 meq/100 g dry weight.

DATA:

Secondary Source; refer to Brunskill et al. (1973).

BRUNSKILL, G.J., ROSENBERG, D.M., SNOW, N.B., VASCOTTO, G.L. and WAGEMANN, R. 1973: Ecological Studies of Aquatic Systems in the Mackenzie-Porcupine Drainages in Relation to Proposed Pipeline and Highway Developments; Environmental-Social Committee, Northern Pipelines, Task Force on Northern Oil Development. Report Nos. 73-40 and 73-41, Ottawa, 131 p. and 345 p.

ABSTRACT:

Plants and animals that live in rivers, streams and lakes (and the physical and chemical parameters that control their growth and reproduction) are being studied as indicators of aquatic ecosystem sensitivity to disruption by gas and oil pipelines, and road developments in the Mackenzie and Porcupine River Valleys. In 1971-72, Fisheries Research Board staff performed a broad chemical and biological survey to identify the different types of ecosystems and the species of organisms in this bast area. From these data, we selected three areas for more intensive study in 1972-75. These are: Fort Simpson area, being in the discontinuous permafrost region of the upper Mackenzie Valley lowlands; the Mackenzie Delta, a fertile and diverse labyrinth of lakes and channels; and the Porcupine River region west of Old Crow (Yukon), being a biologically unique glacial refugium and an area where local natives are largely dependent upon undisturbed seasonal movements of fish and other wildlife. Chemical laboratories, storage, and field H.Q. are at Yellowknife, and chemical and biological laboratories in the Freshwater Institute are utilized.

The results of our survey work in the study area indicated: 1) naturally turbid, silt-laden rivers and lakes supported a less abundant and diversified invertebrate fauna and flora than did aquatic systems with low concentrations of suspended sediment, 2) there was a decline in abundance and diversity of benthic invertebrates with increasing latitude, 3) that water solution ionic strengths varied from extremely dilute (30 umhos/cm at 25°C) to nearly full strength sea water, 4) that suspended sediment concentrations varied from less than 1 g m^{-3} to over 2 000 g m^{-3}, and 5) that bottom sediments in rivers, streams and lakes varied from clay-size to boulder and clean bedrock substrates, with a variety of types of organic matter in the sediment. Natural events related to hydrological cycles and terrain instability caused great fluctuations in the physical and chemical characteristics of water bodies, and their flora and fauna.

To predict the effects of corridor (pipelines and road) development, we have performed controlled experiments in which crude oil was added to a stream in the northern Yukon and a small lake in the Mackenzie Delta. In the Fort Simpson and Inuvik regions, we have utilized disturbances from recent construction of the Mackenzie Highway across stream watersheds as experiments to determine the effects of increased siltation on aquatic ecosystems. Laboratory experimental studies on interactions of oil, silt, dispersing agents, and microbial degradation rates of petroleum products are underway. We have also visited sites of accidental oil spills in Inuvik, Resolute Bay, and Yellowknife Bay to assess the impact of the oil and clean-up activities on aquatic ecosystems. Experimental studies on the effects of increased siltation on lakes and streams are just beginning.

Although our studies are still in progress, we have the following tentative conclusions and recommendations: 1) Increased siltation in a river or lake generally results in decreased abundance and diversity of aquatic organisms. Silt loads in streams will increase during and after construction activities in watersheds. 2) Clear, low-velocity rivers in unstable terrain, and areas where springs occur, should be avoided by corridor development. 3) The effects of crude oil in streams and lakes are rapidd (within hours) and often lethal to many aquatic organisms. 4) Existing oil spill contingency plans are not adequate to prevent or even reduce ecosystem disruption. It will be necessary to contain the inevitably spilled oil in a small area to facilitate clean-up and to reduce environmental changes. In streams and rivers, this will be very difficult, and will require the development of new techniques. 5) Bridges are preferred over culverted road crossings in all but the smallest streams. The area of the right of way, and the number of cleared crossing sites (i.e. temporary crossings) should be kept to a minimum. 6) The rate of recovery of oil or silt disturbed aquatic ecosystems is unknown and requires long (5 year) term studies.

DATA:

The range of daily suspended sediment loads for the Mackenzie River at Norman Wells is 740-2 100 000 tonnes. The suspended-sediment samples were collected using depth integrating samplers (US-DH-49, US-DH-59, and US-DH-48). Repeated depth profiles were made to obtain 2 litres of water, generally at maximum depth in the river cross-section.

CAMOTIM, D. and FRENETTE, M.
1979: Evolution morphologique des estuaires des rivières Romaine et Saint-Jean; Preliminary Report to Hydro-Quebec, July 1979, 76 p.

ABSTRACT:

This report gives a qualitative outlook of the general trends of the expected river regime resulting from the implementation of the proposed Complexe Romaine hydroelectric project. In addition, a preliminary evaluation of the effects of the diversion on the various river sections (downstream of the diversion site on the St-Jean River and downstream of site RO-1 of the Romaine River). Probable hydraulic and physical changes on short and long-term basis are also presented.

DATA:

The results of the three suspended sediment measurements taken at the ROMA-0002 site on the Romaine River are:

Date	Concentration (mg/L)	Load (t/d)
23-05-78	39,7	5 285
09-06-78	8,7	822
13-09-78	1,0	17

CANADA, DEPARTMENT OF TRANSPORT
1969: Sediment Discharge of Les Grèves and Chenal Aux Corbeaux Sections; St. Lawrence Ship Channel Division Report.

ABSTRACT:

This survey was conducted during September and October 1969. It was only the preliminary phase of a long-range program established to determine the amount of material carried and deposited by the St. Lawrence River in that area.

DATA:

Les Grèves Section:

1969, October 17 - Suspended Sediment Load = 11 428 tonnes/day
1969, October 6 - Bed Load = 2.2 tonnes/day
1969, October 7-8 - Bed Load = 2.0 tonnes/day

Chenal Aux Corbeaux Section:

1969, October 29 - Suspended Sediment Load = 1 633 tonnes/day
1969, October 30 - Suspended Sediment Load = 989 tonnes/day
1969, October 29 - Bed Load = 1.2 tons/day
1969, October 30 - Bed Load = 0.5 tons/day

The suspended sediment samples were collected using a U.S. P-63 sampler. Two samples were taken at each position, at 0.2 of the total depth and at 0.8.

An average of the two was then calculated for each position. The results are based on twelve sampling locations at each section. The bedload samples were collected using a Nesper sampler. The results are based on seven samples at Les Grèves section and two samples at Chenal aux Corbeaux section.

CANADA, DEPARTMENT OF TRANSPORT
1970: Sediment Discharge at Les Grèves Section; St. Lawrence Ship Channel Division Report.

ABSTRACT:

This survey was conducted during May and June 1970. It was to be the second phase of a long range program established to determine the solid discharge of the St. Lawrence River.

DATA:

DATE	SUSPENDED SEDIMENT LOAD
May 29	12 154 tons/day
June 02	18 321 tons/day
June 03	17 777 tons/day

The suspended sediment samples were collected using a U.S. P-63 sampler. Two samples were taken at each position, at 0.2 of the total depth and at 0.8. An average of the two was then calculated for each position. The results are based on five sampling locations on May 29, three on June 02 and five on June 03.

CATALIOTTI-VALDINA, D. and LONG, B.F.
1983: Evolution du débit liquide et de la charge solide d'un estuaire sub-boréal: rivière St-Jean, Québec (côte nord du Golfe du St. Laurent). Canadian Journal of Earth Sciences, Vol. 20, No. 1, p. 184-194.

ABSTRACT:

The hydrodynamics of the St. Jean River estuary, particularly the flow dynamics, was evaluated and the mixing mechanisms were studied for fluvial water - marine water. In order to realize this objective, two series of measurements were undertaken on the solid and liquid discharges: the first took place during the spring flood (May 1980), the latter in conditions of lowest level spring tide (August 1980).

The average stream discharge is 1 035 m^3/s during floods and 85 m^3/s at periods of lowest water level. When the stream discharges exceed 160 m^3/s, the wedge of salt water is pushed out of the estuary and no reversed currents are present; there is only a reduction of current velocity at the mouth of the river.

The quantities of solid particles in suspension vary from 96 mg/L during floods (65-95% mineral matter) to 4.6 mg/L for lowest water levels (58% mineral matter).

The general behaviour of the St. Jean River estuary suggests a new type of environment, the subboreal estuaries. They are characterized by a Q_m/Q_r ratio close to the one observed for highly stratified estuaries, but the regime of the material in suspension does not fit with that of micro- or mesotidal estuaries of New England or with that of microtidal estuaries of western Europe.

DATA:

The net daily sediment load of the St. Jean River into the St. Lawrence River is 2 070 t/d in the flood period (1 035 m^3/s) and 18,2 t/d during the summer (185 m^3/s).

This is based on samples taken at 0.2, 0.6 and 0.8 of the total depth at various positions along three transects. Suspended-sediment concentrations were paired with corresponding measured discharges and inserted in a integral equation to calculate the suspended sediment load.

CATALIOTTI-VALDINA, D. and LONG, B.F.
1984: Evolution estuarine d'une rivière régularisée en climat sub-boréal: la rivière aux Outardes (côte nord du golfe du St-Laurent, Québec); Canadian Journal of Earth Sciences, Vol. 25, No. 1, p. 25-34.

ABSTRACT:

The sedimentological evolution of the Rivière aux Outardes estuary was modified considerably during and after the construction of the hydroelectric dams on the river. Prior to 1965, the dominant river discharge was 1 350 m^3/s and the flood peak reached 2 700 m^3/s. Between 1965 and 1975, during the building activities, it fell to 430 m^3/s and since 1955 it remained steady at 555 m^3/s. Now, the variations range from 1 300 m^3/s during discharge periods to 0 m^3/s during some filling periods. The most significant variations in the river discharge related to the creation of the reservoirs have modified the sedimentary equilibria and it is the aim of the present study to improve our understanding of the flow of the non-cohesive materials in the estuary.

Before regulation, the sedimentary processes were dominated by seasonal variations of the river regime: the floods flushed out the fine material from the estuary. Between 1965 and 1975, the river discharge decreased, and the tidal wedge moved upstream. The erosion rate of the cliff edges decreased during working periods of regulation and the entry of marine material was increased particularly at the mouth of the river. The influence of the swell and the tide is more important than the effect of the river discharge.

In the present estuarine system, the sedimentary budget is positive and the source of non-cohensive materials has been changed since the regulation of the river. The principal hydrodynamic processes in the estuarine environment of the Rivière aux Outardes are compared with those of non-regulated rivers in a subboreal climate, such as the Rivière St-Jean and the Rivière La Grande rivers.

DATA:

During the flood tide period, the suspended particulate matter concentration varied between 16,1 mg/L at flowing-water and 6,9 mg/L at slack-water. At low tide, concentrations are smaller than 10 mg/L except in the downstream portion of the estuary where concentrations reach 20 mg/L. The net daily sediment load to the estuary was 85 t/day during low flow and 462 t/day at high flow.

The authors estimate that the high flow period is 70 days which would represent a high flow sediment load of 32 373 tonnes and an annual load of 57 506 tonnes.

CENTREAU
1974: Etude du fleuve St. Laurent, tronçon Varennes-Montmagny. Aspects physiques et sédimentologiques; Rapport to INRS-EAU, 266 p.

ABSTRACT:

This report provides the results of surveys carried out on the St-Lawrence River between Varennes and Montmagny during 1973. Suspended-sediment and bedload samples were collected along 61 various transects. Water temperature was measured directly in the river at the water sampling sites. Laboratory analysis of the water and sediment samples was performed for mineralogical and chemical characteristics. In addition organic matter and microbiological organisms present in the water samples were also examined. Results show that sediment transport is low near Lac St. Pierre and increases rapidly as one goes downstream. Great spatial and temporal variations were also observed.

DATA:

Suspended-sediment loads varied between 17 000 and 58 000 tonnes based on 732 samples.

NOTE: Also Refer to Water Survey of Canada Data.

CHURCH, M.
1972: Baffin Island Sandurs: A Study of Arctic Fluvial Processes; Geological Survey of Canada, Bulletin 216, 308 p.

ABSTRACT:

Valley sandurs form the major postglacial physiographic feature in much of the Canadian Arctic. The conditions favourable for sandur development: presence of an abundant supply of detrital material and the occurrence of relatively frequent floods competent to move the material, are characteristic of proglacial and some periglacial environments.

Nival floods, summer icemelt floods, and summer storm runoff generate significant sediment transport events. Storm runoff is particularly effective in the Arctic since there is little vegetation and the substrate is frozen, so that a high proportion of rainfall runs off immediately. The distribution of runoff events shows a disproportionate number of moderately high flows. Occasionally, extreme floods occur, produced by catastrophic drainage of ponded water from ice margins.

Sediment is transported mainly as bedload, though solution and suspended load are significant. Transport is much greater than the rate of primary detritus production as large volumes of glacially derived material are being redistributed.

Sandur streams are wide and shallow, a characteristic of channels in which most sediment moves as bedload. The major hydraulic adjustment to increasing discharge is made by stream velocity, indicating a change in bed form associated with the rapid increase of sediment transport that results in a sharp decline in flow resistance.

The long profiles of the streams are approximately parabolic; this form is probably conditioned by the nature of the aggradation on the surface as a whole. The sequence of pools and riffles along the channels constitutes a fundamental feature of the river. It appears to function as a regulator of energy expenditure in the stream and concomitantly influences flow resistance and the movement and storage of sediment.

The sandur surface is an aggradational feature. Erosion and deposition occur over wide areas during major floods. Change of stage is rapid so that deposition is often chaotic, and little internal structure occurs in many sediments. Significant pattern is found only in the mean size and variance of coarse materials (cobbles), indicating deposition under conditions of declining competence down sandur.

DATA:

River	Suspended-Sediment Load (Metric Tons)	Bedload (Metric Tons)	Total Sediment Load (Metric Tons)
Lewis, 1963	47 761	215 542	264 233
1964	13 978	48 543	63 022
1965	26 067	99 094	125 809
Ekalugad Fiord North, 1967	21 659	NO DATA	INCOMPLETE
Upper North, 1967	16 325	NO DATA	INCOMPLETE
Middle, 1967	3 852	60 347	64 461
Upper Middle, 1967	6 934	NO DATA	INCOMPLETE
South, 1967	3 523	34 487	38 442
Upper South, 1967	4 378	100 041	104 851
Total Ekalugad, 1967	27 637	INCOMPLETE	INCOMPLETE
South, 1968	239	66	492
Upper South, 1968	72	2 577	2 835

a) Suspended sediment loads were calculated from rating curves.

b) Bedloads were calculated from hourly flow data using Meyer-Peter and Müller formula with threshold adjusted on the basis of field observations of competence for cobbles of the bed of the rivers.

CHURCH, M. and RYDER, J.M.
1972: Paraglacial Sedimentation: A Consideration of Fluvial Processes Conditioned by Glaciation; Geological Society of America Bulletin, Vol. 83, p. 3059-3072.

ABSTRACT:

Glaciation is schematically considered as a perturbation of "normal" fluvial conditions. Drift is unstable in a proglacial or postglacial fluvial environment, resulting in heightened sediment movement that continues as long as drift material remains easily accessible for fluvial erosion and transportation. Sediment yield bears no relation to concurrent primary production of weathered debris.

Examples of such "paraglacial" denudation and sedimentation are reported from two contrasting areas. Postglacial valley alluvial deposits are widespread in central Baffin Island where rapid sedimentation continues today; estimated denudation rates are an order of magnitude higher than in comparable unperturbed areas. In south-central British Columbia, rapid sedimentation during the paraglacial period contrasts sharply with present-day conditions.

DATA:

Secondary Source; Refer to Church (1972).

CLUIS, D., COUILLARD, D., LAPOINTE, R., POTVIN, L., ROUSSEAU, A., SASSEVILLE, J.L., TESSIER, A.
1975: Etude du Fleuve St. Laurent (tronçon Varennes-Montmagny): Synthèses des études 1973-74; INRS-Eau, Rapport Scientifique No. 48, 141 p.

ABSTRACT:

This report is a synthesis of results obtained in 1973-1974 on the St. Lawrence River between Varennes and Montmagny by various consulting firms.

DATA:

Secondary Source; Refer to Centreau (1974).

COUILLARD, D.
1982: Géologie et géochimie du fleuve de l'estuaire et du golfe Saint-Laurent (Canada); Canadian Journal of Earth Sciences, Vol. 19, No. 7, p. 1492-1506.

ABSTRACT:

This article provides an outline of conditions of particulate material and sediments in the river, estuarine, and gulf sections of the St. Lawrence (Quebec, Canada). The concentration of solids in the river above Lac St. Pierre varies between 4 and 10 mg/L, whereas downstream towards Quebec the concentrations rise to 30-50 mg/L. Within the exception of the Sorel delta, this section of the river does not constitute major sink of sedimentary materials, but the surface sediments of the river are enriched with phosphorus, polychlorinated biphenyls, copper, and lead. The portion immediately upstream from Ile d'Orléans is the interface and at this point is a region of high

concentrations of suspended solids (up to 300 mg/L). The process of sedimentation in the estuary is complicated by the coagulation of fine particles after contact with salt water. As a result, there is a zone of high sedimentation rates of fine particulates enriched in phosphorus, organic matter, and polychlorinated biphenyls in the area of Ile d'Orleans, making constant dredging necessary. Downstream from Ile D'Orleans is a decrease from 40-80 mg/L suspended solids to 1-2 mg/L in the Gulf of St. Lawrence.

DATA:

St. Lawrence River	Mean Concentration (mg/L)
a) Estuary Reach	
1) Ile d'Orleans to Ile aux Coudres	40-80
2) Rivière du Loup (City)	5
3) Saguenay River (Mouth)	2
4) East of Saguenay River	<1
b) Gulf of St. Lawrence	
a) Laurentian Trough	0,6-0,8
b) Mean of Gulf	<1,0

DAVIES, K.F.
1975: Mackenzie River Input to the Beaufort Sea; Beaufort Sea Project, Technical Report #15, 72 p.

ABSTRACT:

This report contains a summary of the findings under the study, "Mackenzie River Input to the Beaufort Sea," one of a series of studies comprising the Beaufort Sea Project.

Comprehensive descriptions of the gauging sites and methods used are included in the report. Distribution of flow in the main channels as a percentage of total flow has been determined on a month-by-month basis for the period July 1974 to June 1975.

Suspended sediment transport, ice thickness, and water temperature in the Delta are also discussed and the results shown.

All data contained in the report are provisional, subject to correction, pending publication in the Annual Departmental Reports.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

ENVIRONMENT CANADA
1980: Historical Sediment Data Summary Canadian Rivers to 1978; Biennial Publication, Inland Waters Directorate, Water Resources Branch, Water Survey of Canada, 121 p.

ABSTRACT:

The first edition of a new publication series titled Historical Sediment Data Summary for Canadian Rivers was produced for data to 1974. This publication contains a summary of historical monthly and annual mean suspended sediment load, and annual extremes of daily suspended sediment concentration and loads and total annual suspended load. Commencing with the 1978 publication, data are presented entirely in the International System of Units (SI).

ENVIRONMENT CANADA
1984: Sediment Data Reference Index Canada 1982; Biennial Publication; Inland Waters Directorate, Water Resources Branch, Water Survey of Canada, 47 p.

ABSTRACT:

The first edition of a Sediment Data Reference Index was published for data to 1972. It contains a tabulation of locations where sediment data in Canada were collected by the Water Survey of Canada. The index has been subdivided alphabetically by province or territory, with sediment survey stations listed alphabetically. Commencing with the 1978 publication, data are presented in the International System of Units (SI) and will continue to be published biennially.

ENVIRONMENT CANADA
1985: Sediment Data Canadian Rivers 1983; Annual Publication, Inland Waters Directorate, Water Resources Branch, Water Survey of Canada, 233 p.

ABSTRACT:

This paper contains data on streamflow, daily suspended sediment discharges, daily mean suspended sediment concentration, particle-size distribution of suspended sediment, particle-size distribution of bedload, and water temperature for days sediment samples were collected for the Calendar year 1983.

NOTE: During the years 1948 to 1960, some sediment data were collected for several Prairie rivers to meet the needs of particular projects. The first Paper containing sediment data incorporates a selection of these data and also data for part of the year ending September 30, 1961 at stations established for the continuing program. The second issue is a biennial publication covering only the continuing program for the 1962 and 1963 water years. All subsequent editions titled Sediment Data Canadian Rivers were published annually. Commencing with the 1978 publication, data are presented entirely in the International System of Units (SI).

FARROW, G.E., SYVITSKI, J.P.M., TUNNICLIFFE, V.
1983: Suspended Particulate Loading on the Microbenthos in a Highly Turbid Fjord: Knight Inlet, British Columbia; Canadian Journal of Fisheries and Aquatic Sciences, Vol. 40, Supplement No. 1, p. 273-288.

ABSTRACT:

Knight Inlet is a deep, low-energy but well-oxygenated fjord. The effects of turbidity are principally those of seasonally very high vertical flux from the sediment-laden surface layer. Submersible observations of the benthos are related to suspended load and sedimentation rate data. The bayhead delta slope receives a continual rain of glacial silt (30 cm/yr) and has summer sedimentation rates of 4 $kg \cdot m^2 \cdot d^1$.

The epifauna of the steep fjord walls show a marked down-inlet increase in abundance, and the number of species increases from 9 to 45. Brachiopods (Laqueus californianus), solitary corals (Caryophyllia/Cyathoceros), and encrusting sponges are remarkably tolerant of high turbidity. The high sedimentation rates affect the epifauna in three ways: (1) subjection to the ubiquitous "gentle rain" of flocs and agglomerates; (2) more locally, microturbidity flows set off by biological resuspension of unstable slope sediment; and (3) major slides of rock and/or sediment. Submarine soil-creep limits the slope infauna, by burrows requiring repeated reexcavation.

Down-inlet decrease in sedimentation rate is accompagnied by a change in feeding type. In the upper inlet, suspension feeders taking particles <8 μm (e.g. sabellids, brachiopods) probably utilize bacteria associated with the high vertical flux of SPM! In the middle inlet, selective suspension feeders (e.g. crinoids, gorgonians) sort the SPM for larger particles. In the lower inlet, filter feeders (e.g. barnacles, glass sponges) increase, especially where currents are stronger. The soft-bottom detritus feeders also show a change from epibenthic forms (e.g. pandalid shrimp, spider crabs) in the upper inlet, through burrowing shrimp in the middle inlet, to phiuroids in the lower inlet. These changes are correlated with the greater amounts of organic carbon preserved in bottom sediments as they are less diluted by glacially derived inorganic material.

The modern-day "turbid association" of brachiopods, solitary corals, and sponges recalls typical outer shelf-basinal shale facies of the Palaeozoic. Turbid, low-energy environments were thus colonized early but faunas have since become less diverse.

DATA:

Klinaklini River annual suspended sediment load is 4.73 x 10^6 tonnes/yr. This result is based on generated flow and sediment data using a deterministic/empirical loading model developed for Bute Inlet. Suspended sediment data was collected using a Secchi disk and submersible observations.

FORBES, D.L.
1981: Babbage River Delta and Lagoon: Hydrology and Sedimentology of an Arctic Estuarine System; Unpublished Ph.D. Thesis, University of British Columbia, 554 p.

ABSTRACT:

Inputs, transfer processes, and storage characteristics of water and sediment have been investigated in a 40-km^2 estuarine system on the central Yukon coast. The setting is transgressive, microtidal and high-latitude (69°N). The Babbage Estuary system can be subdivided into fluvial, tidal-distributary, delta-plain, intertidal, lagoon, marginal-supratidal, and barrier subsystems, each associated with one or more distinctive depositional environments and characteristics lithofacies assemblages. The structure of the system has been examined in terms of links between subsystems and overall system response to input perturbations. Although the propagation of tide and surge within the estuary may be trested as a quasi-linear stochastic process, transfers of fluvial water and sediment through the system are highly non-linear. Furthermore, the parameters of the system change dramatically on an annual cycle.

Inputs and associated system responses are dominated in the short run by seasonal- and synoptic-scale variance, the former reflecting major seasonal adjustments in the phase distribution, circulation process, and input regime of the estuary. The annual salinity cycle, with a range of at least 60 ppt, exhibits a short reaction and long relaxation response to major snowmelt runoff inputs in May or June, when salt water is flushed completely out of the estuary. Wind-generated waves are effectively absent from the system during 8-9 months of the year, but play a major role during the open-water season. Although direct transport of sediment by ice is relatively unimportant, ice effects are pervasive; they include, in addition to restriction of winter runoff and surface wave generation, creation of hypersaline conditions, control of the sedimentologically important flood events on deltaic supratidal flats, enhanced rates of coastal recession due to thermal degradation of ground ice, and production of distinctive thermokarst morphology on supratidal surfaces. Water level, storage volume, salinity, and suspended sediment series during the open-water season in the lagoon are dominated by synoptic-scale wind effects. In the delta, the major synoptic-scale anomalies of sediment concentration are related to storm runoff. Fluvial clastic sediment inputs to the estuary exceed 10^8 kg a^{-1}, almost an order of magnitude greater than the estimated littoral transport input. More than 97% of the fluvial input may occur in June; of this approximately half may be exported directly from the system.

At long time scales, the estuarine system has been dominated by rising sea level and coastal recession; Holocene climatic fluctuations may also have been important. A transgressive sequence has developed, including various distinctive features, notably the absence or limited development of aeolian, backbarrier-margin, tidal-delta, and intertidal marsh facies, a largely afaunal intertidal component, and deltaic deposits with poorly developed levees and abundant lake basins. The basal fluvial component includes a sinuous gravel channel assemblage of

a hitherto poorly documented type. The Babbage Estuary barrier sequence is primarily transgressive, but incorporates localized elements of progradational and inlet-migration models. Examples of major transgressive, progradational, and inlet-fill barrier sequences occur in close proximity on the central Yukon coast.

DATA:

1) Sediment transport summary, Babbage River below Tulugaq (Crow) River, 1974-1976.

	days miss1	days comp2	Sediment transport in units of 10^6 kg TDS	TSS	TBS	Total	TMS
May 1974	26[3]	0					37.08
June	14	0	30.84	103.96	48.94	183.74	70.94
July	5	26	18.89	8.40	1.70	28.49	26.38
Aug	17	8	8.80	8.86	1.90	19.56	9.78
Sept	30	0					
May 1975	22[4]	0	4.0	8.0	0.5	12.5	6.02
June	0	1	37.30	238.46	78.35	354.11	354.11
July	0	31	12.14	0.72	0.03	12.90	12.90
Aug	0	31	14.68	1.54	0.07	16.29	16.29
Sept	27	3					1.47
May 1976	31[5]	0					
June	1	5	32.17	167.63	66.42	266.22	249.13
July	1	28	17.09	4.13	0.38	21.60	18.96
Aug	5	26	12.76	1.20	0.08	14.04	13.49
Sept	11	19	10.8	0.3	0.01	11.1	7.37
1974 26 May - 15 August			60.66	138.23	60.19	159.09	144.18
1975 23 May - 3 Sept			67.76	244.67	78.66	391.12	391.12
1976 1 June - 19 Sept			69.21	173.12	66.89	309.22	288.95

TDS: total dissolved solids
TSS: total supended solids
TBS: total bed-contact solids
total: sum of TDS+TSS+TBS computed from ratings, with interpolation or limited extrapolation
TMS: total transport from ratings for intervals with observational data

1: number of days missing from record
2: number of days with continuous stage record
3: apparent first flow 16 May 1974
4: no major flow before start of observations 23 May 1975
5: flow ~30 m^3s^{-1} estimated from air 10 May 1975; river observed regularly from 26 May; June totals are thought to include first major flow event

2) Sediment transport summary, Deep Creek above Babbage distributary, 1975 and 1976.

	days miss1	days comp2	Sediment transport in units of 10^6 kg TDS	TSS	TBS	Total	TMS
May 1975	22[3]	9	0.	0.	0.	0.	0.
June	10[4]	0	2.78	25.27	0.80	28.85	27.27
July[5]							
May 1976	31[6]	0					
June	4	0	3.30	33.38	0.30	36.64	35.81
July	0	31	0.78	1.76	0.002	2.54	1.54
Aug	0	31	0.28	0.17	0.000	0.45	0.45
Sept	12	18	0.11	0.004	0.000	0.11	0.07

1: number of days missing from record
2: number of days with continuous stage record
3: river observed from 23 May 1975: no flow in May
4: first flow in snow over bottomfast ice 3 June; transport estimates based on single daily discharge measurements with TDS and TSS determinations
5: no estimates for July and August due to persistent failure of stage recorder
6: irregular observations suggest that little or no flow occurred during May 1976

FORBES, D.L.
1983: Morphology and Sedimentology of a Sinuous Gravel-Bed Channel System: Lower Babbage River, Yukon Coastal Plain, Canada; Special Publication of the International Association of Sedimentologist, Vol. 6, p. 195-206.

ABSTRACT:

The lower Babbage River is a non-draibed sinuous gravel-bed stream of the poorly documented class-5 meandering channel facies assemblage (Jackson, 1978). It exhibits a low-Arctic nival runoff regime. The low-flow channel has a sinuosity of 1.89, a mean slope of 7.4×10^{-4}, mean width 62 m, mean maximum depth 1.36 m, and a variable width/depth ratio $24 \leq b/h^* \leq 226$. The sinuosity and mean width of the channel zone are respectively 1.3 x 222 m. The channel is dominated by lateral or point bars, diagonal bars, and a prominent pool-riffle sequence. The alluvial sediments are described using a modified version of the lithofacies classification proposed by Miall (1978). Imbricate gravel of lithofacies Gm ($12 < d_{50} < 20$ mm) forms an armour layer on channel-floor and bar-top surfaces. Bar-body deposits of sandy gravel ($6 < d_{50} < 12$ mm) include planar cross-stratified gravel (G_p) and massive or crudely stratified units (Gm). Bar-top sediments include gravel sheets and armour surfaces (Gm), shallow scours (Ge), and scour fills or veneers of sand and mud. Through cross-stratified scour- or channel-fill gravels (Gt) are plausible but unconfirmed additions to the lithofacies set. Parallel-ridge gravels (Gr) are found only in

reaches subject to overflow icing. Bar-tail sediments include planar cross-stratified sands (Sp, St, Sr). Channel-zone gravel bodies may exhibit planar bases and convex tops, with total width of 100-200 m and maximum thickness greater than 3 m. Overbank sediments, including peat (C), ice (I), stratified silts and sands (Fl and Sh; $0.01 < d_{50} < 0.3$ m), and organic muds (Fsc), may exceed 8 m in thickness and cover a much greater area than any of the channel facies in the lower valley.

DATA:

Secondary Source; Refer to Forbes (1981).

FRENETTE, M.
1977: Aspects physiques, hydrauliques et morphosédimentologiques des rivières Nottaway, Broadback et Rupert 1977; Report to the James Bay Energy Corporation, 86 p.

DATA:

The annual total load from the Nottaway, Broadback and Rupert Rivers into Rupert Bay is estimated to be between 0.8×10^6 to 0.9×10^6 tonnes.

FRENETTE, M.
1979: Aménagement hydroélectrique des rivières Nottaway, Broadback, Rupert; Internal Report, Quebec Hydro.

DATA:

Résumé des bilans sédimentologiques à l'embouchure des rivières Nottaway, Broadback et Rupert Conditions actuelles

a) Apports solides inter-annuels (suspension et charriage)

Débit solide moyen	Nottaway (t/an)	Broadback (t/an)	Rupert (t/an)	Total (t/an)
Suspension (Sable, silt, argile et matière organique)	403 460 (51%)	148 530 (19%)	236 595 (30%)	788 585 (100%)
Charriage (sable et gravier fin)	40 000 (26%)	15 000 (10%)	100 000 (64%)	155 000 (100%)
Total baie de Rupert	443 460 (47%)	163 530 (17%)	336 595 (36%)	943 585 (100%)

FRENETTE, M. and LARINIER, M.
1973: Some Results of the Sediment Regime of the St. Lawrence River; Proceedings of the 9th Canadian Hydrology Symposium on Fluvial Processes and Sedimentation, University of Alberta, Edmonton, May 8-9, 1973, p. 138-157.

ABSTRACT:

This paper describes briefly and illustrates from observations and analyses some dominant features of the sedimentologic regime of the St. Lawrence River.

Some research work on the dynamic of the solids in the St. Lawrence River has been performed since 1970 between Varennes and Ile d'Orléans and at this stage, the results allow to brush a preliminary picture of the sediment behaviour in some reaches, more particularly in the reach Cornwall-Varennes, which includes part of the Ottawa River and the complex hydraulic regime around the Montreal Islands. In the reach Varennes- Ile d'Orléans, the information is very fragmentary; nevertheless, the paper gives a general outline of the suspended sediment regime along this reach.

DATA:

STATION	AVERAGE SUSPENDED SEDIMENT LOAD
Outlet of Lake Ontario	1 633 tonnes/day
Cornwall	4 807 tonnes/day
Outlet of Lake St. Louis	3 900 tonnes/day
Varennes	5 079 tonnes/day
Mercier Bridge (Montreal)	6 349 tonnes/day or 2.3×10^6 tonnes/year
Quebec	10 884-13 605 tonnes/day or 4.5×10^6 tonnes/day

GILBERT, R.
1978: Observations on Oceanography and Sedimentation at Pangnirtung Fiord, Baffin Island; Maritime Sediments, Vol. 14, No. 1, p. 1-9.

ABSTRACT:

Pangnirtung Fiord is a glacial trough draining the southwest portion of Penny Icecap, Baffin Island. Sills associated with riegels divide the fiord into four basins. Despite a large inflow of sediment from streams draining the glaciers and Penny Icecap, glacio-marine sediments have been deposited in sufficient thickness to mask glacial features only in the central portion of the fiord. A major trench in the fiord floor is believed to result from erosion by turbidity currents. A shallow sill (12 to 22 m below mean tide level) at the mouth of the fiord, a large tidal range (up to 6.7 m), and moderate fresh water inflow strongly influence circulation and stability of fiord water. Replacement of bottom water occurs frequently or continuously during the year and helps to determine the distribution of sediment. The oxygen-rich bottom water supports a large benthic fauna which severely bioturbates the sediments making them useless for the interpretation of Holocene events in the region.

DATA:

RIVER	SUSPENDED SEDIMENT CONCENTRATION
Overload River	greater than 2 g/L
Weaseal River	greater than 2 g/L

HARDY ASSOCIATES (1978) LTD.
1982: Alluvial Sedimentation of the Mackenzie River System; Report Prepared for B.C. Hydro and Power Authority, 73 p. + Appendices (2 volumes).

ABSTRACT:

This report provides the results of a study of the alluvial sedimentation patterns and related vegetation succession along the Liard-Mackenzie River System and at selected study areas in the delta.

DATA:

Secondary Source; Refer to Water Survey of Canada Data and to B.C. Hydro and Power Authority Data.

HARPER, J.R. and PENLAND, S.
1982: Beaufort Sea Sediment Dynamics. Final Report to the Alantic Geoscience Centre, October, 1982, 40 p.

ABSTRACT:

Numerous scientific studies have been conducted in the Beaufort Sea since the original Beaufort Sea Project of 1974 and 1975, but, to date, these studies have not been synthesized with respect to sediment dispersal. This report provides a state-of-the-art interpretation of information related to sediment dynamics and outlines a revised sediment dispersal model for the Beaufort Sea.

Analysis of the sediment budget indicates that the Mackenzie River is the major contributor of sediment to the southern Beaufort Sea system, contributing over 95 percent of the total. Analysis of mud volumes and sedimentation rates on the shelf indicates that the major portion of the sediment contributed by the Mackenzie River is deposited in shallow water near the delta. This observation is supported by analysis of suspended sediment concentrations (SSC), which were derived from LANDSAT imagery enhancement. The processed images often show very high SSC values (>100 mg/L) inside the 10-m countour and low SSC values (<10 mg/L) seaward of the 10-m contour with a strong SSC gradient in the 5-m to 10-m water depths. These analyses indicate that the proximal delta area serves as the primary sediment sink for river sediment. The enhanced LANDSAT imagery also shows that the turbid water of the Mackenzie River plume is frequently deflected to the north and east from the delta and serves as a sediment source to these areas of the shelf, although sedimentation rates (<0.2 mm/yr) are nearly one order of magnitude less than those near the delta (>2 mm/yr).

Wave climate data and current meter data were analyzed for potential transport frequency and potential transport directions. The results show that the shelf seaward of the 20-m contour is dormant in terms of transport potential except on the western shelf where slightly stronger currents occur. Landward of the 20-m contour sediments can be transported by combined wave and current action; transport is most active inside the 5-m contour where waves may suspend material over 50 percent of the time. On the central and eastern part of the shelf net transport is directed to the northeast; longshore transport at the coast is controlled by the dominant northwest storm wave approach and is directed to the east or south, depending on shoreline orientation. Shelf transport on the western shelf may be directed to either the northwest or southeast.

Geologically recent changes in sea level and supply patterns have affected shelf sediment dispersal. Areas of the shelf with little or no ongoing sedimentation (the eastern-most and western-most parts of the shelf) have coarse surficial sediments, which are thought to be relict and deposited under different hydrodynamic conditions than exist at present. As such, the shelf morphology and sediment character is a product of both present and past (early to mid-Holocene) sedimentary process.

DATA:

Secondary Source; Refer to Forbes (1981) and McDonald and Lewis (1973).

HOLEMAN, J.N.
1968: The Sediment Yield of Major Rivers of the World; Water Resources Research, Vol. 4, p. 737-747.

ABSTRACT:

The amount of suspended sediment transported by rivers to the seas each year is tabulated. The major rivers are ranked in order of tons of sediment transported per year and drainage area and water discharge data are included. The rivers are listed by continents in subsequent tables with data on drainage area, annual sediment yields in tons, sediment production rates in tons per square mile per year, the years of sediment measurement, and the sources of data. This sample represents more than one-third of the land contributing water-borne sediment to the seas and, if representative, indicates an annual world sediment yield of 20 billion (20×10^9) tons. The data suggest that Africa, Europe, and Australia have very low sediment yields (<120 tons per square mile per year), South America's rate is low, North America's is moderate, and Asia's is high to the degree of yielding up to 80% of the sediment reaching the oceans annually.

DATA:

Tertiary Source.

HOOS, L.M. and PACKMAN, G.A.
1974: The Fraser River Estuary-Status of Environmental Knowledge to 1974; Report of the Estuary Working Group, Environment Canada, Regional Board, Pacific Region, Special Estuary Series, No. 1, 518 p.

ABSTRACT:

This report consists of a compilation of published and new information dealing with a variety of subjects pertaining to the Fraser River Estuary. These include river discharge and sediment regimes, tides and mixing of freshwater and salt water, climate, various ecosystems such as salt marshes, wildlife, benthic communities, erosional processes and engineering structures.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

JOHNSTON, W.A.
1921: Sedimentation of the Fraser River Delta; Geological Survey of Canada, Memoir 125, 46 p.

ABSTRACT:

This report gives the results of the investigation of the Fraser River in 1919 and 1920 and deals chiefly with the characteristics of the river between New Westminster and the Strait of Georgia.

DATA:

Table IX shows the results of the analyses of composite samples of Fraser River water at New Westminster. From May 5 to December 31, 1919 concentrations ranged from 20 to 210 mg/L. From January 2 to July 30, 1920 concentrations ranged from 10 to 230 mg/L.

NOTE: Also Refer to Department of Public Works Data.

KELLERHALS, R.
1984: Review of Sediment Survey Program - Lower Fraser River, British Columbia; Consulting Report Prepared for the Sediment Survey Section, Water Resources Branch, Inland Waters Directorate, Environment Canada, 51 p.

ABSTRACT:

This report is divided into three sections: 1) a description of the available Fraser River sediment data, 2) a detailed examination of sediment issues and problems on the Lower Fraser River and 3) recommendations for continued sediment work on the Lower Fraser river.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

KIDD, G.J.A.
1953: Fraser River Suspended Sediment Survey; Interim Report for Period 1959-52, Water Rights Branch, Department of Land and Forests, Mimeo, 46 p.

DATA:

Annual load = 18.5 x 10^6 tonnes.

KING, W.A.
1980: The Geomorphological and Sedimentology of the Lower Reaches of the Attawapiskat River, James Bay, Ontario; Unpublished M.Sc. Thesis, University of Guelph, 214 p.

ABSTRACT:

The modern environments, processes and sediments of the lower reaches of the Attawapiskat River have been analysed to elucidate the initiation, maintenance, and disruption of the river's anastomosing channel pattern. The relatively young (8000 years) subarctic river is entrenching into the emerging Hudson Bay Lowland. The stable multi-channel character is initiated in the intertidal and shallow subtidal zones. Several embryonic channels are formed by divergence of the river plume around highs in the resistant till substratum and around local modern coarse grained deposits generated by ice-rafting. These channels are subsequently deepened by river flow and tidal currents. As the sea regresses, the channel banks are preferentially colonized and stabilized by vegetation. They undergo very little lateral migration and no new secondary channels are formed.

The river has a subarctic nival hydrologic regime. The lower reaches are influenced by mixed, semi-diurnal tides (2.36 m spring tide) which penetrate up to 7.5 km inland along the main channel. Side channels are flood tide dominated with brackish (13.2%) water penetrating up to 20 km inland. The river carries very little bedload but a sizable (94 mg/l) suspended sediment load, most of which is flushed into James Bay. Alluvial deposits are present as thin (2-4 m), narrow (150 m) levees; as occasional sandy bars which form in sheltered areas of islands and shoals; and as thin (5 cm) silty veneers on the floors of secondary channels. Near the coast, side channels are kept open by scouring during floods and by tidal currents. However, farther inland (30 km) the more rapidly entrenching main channel captures their flow, and the river becomes an irregularly meandering stream.

Pleistocene tills overlain by a Holocene regressive sequence are exposed in the river banks. The regressive sequence is composed of a lower subtidal, fossiliferous clayey-silt unit overlain sharply by tidal flat deposits of extremely variable lithology and texture. The intertidal deposits are overlain gradationally by silty marsh deposits with thin (0.1 cm) discontinuous organic-rich laminae plus lenticular sandy storm beds. The marsh grades upward into levee deposits characterized by thicker (0.2 cm) and more regular organic-rich laminae alternating with thin (1.5 cm) sandy silt beds. In rare instances, the till substratum is overlain by a totally alluvial sequence (2.5 m

thick) characterized by ripple marked sandy bar deposits. These sediments grade upward into levee sediments of vegetated islands. Ice-rafted sediments commonly occur in all of the sedimentary environments.

Other anastomosing rivers reported in the literature reveal basic differences from the Attawapiskat River, such as crevassing and thick alluvial deposits. However, strong similarities exist which may be useful in interpreting deposits of ancient anastomosing streams. These similarities include high and abrupt lateral variability in texture, a predominance of overbank sedimentation, limited or negligible point bar deposits, and a lack of numerous in-channel bars.

DATA:

The suspended sediment concentration of the Albany and upper Attawapiskat Rivers does not change significantly and an average sediment concentration of 14 mg/L is carried by floods ranging between 500 and 1 700 m^3/s.

KING, W.A. and MARTINI, I.P.
1984: Morphology and Recent Sediments of the Lower Anastomosing Reaches of the Attawapiskat River, James Bay, Ontario, Canada Sedimentary Geology, Vol. 37, No. 4, p. 295-320.

ABSTRACT:

The Attawapiskat River is one of the major low-gradient rivers which cross the flat wetlands of the Hudson Bay Lowland. It has a nival regime leading to strong, short-duration spring floods during which considerable amount of sediment is carried. For the remainder of the year only organic matter is transported in solution and suspension. The land is isostatically rebounding after the Pleistocene glaciations. The river downcuts through the softer Holocene estuarine basal clays and the Pleistocene tills, to the Paleozoic carbonate bedrock. The river develops an anastomosing pattern in the lower reaches and it acquires an irregular meandering character inland. It does not construct a significantly thick delta as the river-borne sediments are dispersed along the coasts by tide, longshore currents and ice rafting. The river is subjected to frequent ice jams in its lower reaches as warmer southern waters flow toward the still frozen mouth and sea. During the jams, secondary channels become active, floodings develop and sedimentation occurs on the levees. Ice scours and ice-rafted materials affect the river banks greatly.

The principal sedimentary environments within the river consist of: (1) erosional shoals covered by boulder and pebble lags over till; (2) sorted coarse to medium-sized sands in junction bars downstream from islands; these sands frequently develop gas bubbles, and they contain characteristic fining-upward sequences from boulder pavements at the base, grading up into rippled sand with abundant organic matter, grading up into laminated silt and sand and organic matter; (3) secondary channels, which develop thin silty and clay drapes on eroded hard substratum and are filled eventually by thick peats; and (4) river

banks which show well-developed regressive sequences from Pleistocene tills at the base, overlain by estuarine sparsely fossiliferous clays, capped by thin conglomeratic units with abundant reworked Macoma balthica shells, grading upward into upper tidal flat sand, irregularly laminated sand and silt of marshes, and regular interbedding of sand, silt and organic laters of the levees at the top.

DATA:

Secondary Source; Refer to King (1980).

KNIGHT, R.J.
1977: Sediments, Bedforms and Hydraulics in a Macrotidal Environment, Cobequid Bay (Bay of Fundy) Nova Scotia, Unpublished Ph.D. Thesis, McMaster University, Hamilton, 693 p.

ABSTRACT:

Macrotidal environments, such as Cobequid Bay which has a mean tidal range of 11.7 m (maximum measured range of 16.3 m) near its mouth, are not uncommon in the world's coastal ocean. Such areas are, however, the least studied compared to other areas with smaller tidal ranges.

Cobequid Bay is a large, funnel-shaped estuary located at the head of the Bay of Fundy. The bay's waters are well-mixed due to the large tidal range and because river input is small compared to the tidal exchange. The morphology and distribution of sediments and bedforms is mainly the result of the tides. The bay is flanked by an intertidal bedrock platform that is either exposed or covered with a veneer of sediments. Suspended sediment concentrations are high (up to 2 700 mg/L), but mudflats occur only in the small estuaries and bay. Sand deposition is localized in the centre of the bay as an intertidal to subtidal channel-bar complex. The sand bars are elongate features, 1 to 5 km long, asymmetrical in transverse section, oriented parallel to the currents, and covered with megaripples (length = 1-12 m) and sand waves (length = 10-30 m). The bars are composed of well-sorted, medium-grained sands that range from 5 to 15 m thick (decreasing in thickness and relief towards the head of the bay), and that are underlain by local accumulations (up to 10 m) of premodern (possiby Pleistocene) sediments and bedrock.

The tidal currents are semidiurnal, reversing and time-velocity asymmetrical. Maximum near bottom (0.5 m) speeds ranged from 0.3 to 1.0 m/s over the bars, and up to 2.0 m/s in the channels. Flow durations averaged 4.5 and 3.5 h for the ebb and flood over the bars, and 7.0 and 5.5 h for the ebb and flood in the channels. Current strengths and durations decreased towards: the shore, the bar crests and the head of the bay. The ebb and flood are dominated by a high-water 'sheet-flow' and a low-water 'channel-flow' relative to the low water emergence of the bar crests. The currents flow across the bars at an oblique angle to the crestlines during the 'sheet-flow' phase. The strength, duration and asymmetry of the currents are controlled by topographic shielding on and by the bars, the different hydraulic geometries and hypsometries of the channels and the variation of tidal range during the lunear month. The gently sloping sides of the bars are flood-dominated and the steep sides are ebb-dominated.

The measured vertical velocity profiles indicate that velocities are proportional to the logarithm of the depth despite the presence of large bedforms and large depths of flow. Three types of velocity profile shape are related to the location of the measured vertical over the bedforms and to time during the tidal cycle.

Bedform scale, internal and external geometry, and net migration rates differ with sediment size, and flow strength, duration and asymmetry. Megaripples move faster (0.2 to 0.8 m/tidal cycle) than sand waves (0.1 to 0.3 m/tidal cycle), and become larger and more three-dimensional with increasing flow strength and duration. The sequence of bedform development (plane bed→ripples→sand waves→megaripples) with increasing flow strength on the bars is similar to that observed in flumes and other sedimentary environments. Seven different bedform facies are defined from the external morphology and scale of the intertidal bedforms on the bars and their areal distribution is described relative to a typical macrotidal sand bar. Megaripples reverse their asymmetry during each ebb and flood, but sand waves do not. Most of the preserved sedimentary structures in the intertidal bedforms are flood-oriented and are from ripples and megaripples. Sets of cross-bedding are separated by 'reactivation surfaces' and surfaces of discontinuity, and "herringbone cross-bedding" is uncommon.

The flow friction factor changes during the tidal cycle with different stages of bedform development and reversal, and suspended sediment concentrations. The friction factor at the time of maximum ebb speeds varies from about 0.032 for small megaripples to 0.050 for larger megaripples.

In winter, the presence of the frozen crust and the grounding of drift ice on the bars effectively stops the development of large bedforms, and obliterates or reduces the size of the bedforms from the summer.

The asymmetry of the currents results in the residual circulation of currents and sediment around the bars, or parts of the bars, within closed, or clearly closed, "elliptical loops". Coriolis effects are unimportant with respect to the pattern of general circulation within the bay which resembles a large "ebb tidal delta". The general properties of the sediments, bedforms and current hydraulics of the sand-body complex in Cobequid Bay are similar to those of other tidal environments, despite dissimilarities of tidal range and the scale, relief and topographic complexity of the elongate sand bars in a macrotidal environment.

DATA

Secondary Source: Refer to Water Survey of Canada Data.

KRANCK, K. and RUFFMAN, A.
1982: Sedimentation in James Bay; Naturaliste Canadien, Vol. 109, No. 3-4, p. 353-361.

ABSTRACT:

The sedimentary regime of James Bay is examined on the basis of published and unpublished data. Rivers are estimated to bring 4.12 x

10^7 tonnes per year of sediment to the bay. A large portion of this is deposited near shore but silt and clay transported offshore have formed a nearly continuous mud deposit over the bay bottom. Suspended sediment levels in the bay are relatively high, estimated to range from 1 to 100 mg/L. Concentrations decrease from the head of the bay northward, and at the boundary with Hudson Bay decrease sharply. A counterclockwise current circulation transports sediment towards the northeastern entrance of the bay.

DATA:

Secondary Source; Refer to Aubin et al. (1976) and Stichling (1973).

LANGLEY, H.I.
1971: An Experiment in Bedload Sampling by Pumping; Report, Department of Public Works Canada, Vancouver, British Columbia, 19 p.

ABSTRACT:

This report describes a test-run of the bedload pump sampling techniques on the Nortn Arm of the Fraser River at Vancouver during the spring freshet of 1971. Results demonstrate:

1. Measurement of suspended load in the bottom 12" is of a value at least equal to the study of bedload.

2. A relatively large amount of information can be secured in a short time and at moderate cost by using the pumping method for sediment investigations.

3. The supporting program of suspended load observations was valuable in completing the sediment transport picture and in establishing confidence in the accuracy of the test.

DATA:

Figure 12 of the report shows bedload variations for a period of 48 hours (June 16-18, 1971).

LANGLEY, H.I.
1973: An Experiment in Bedload Sampling by Pumping; Proceedings of the 9th Canadian Hydrology Symposium on Fluvial Processes and Sedimentation, University of Alberta, May 8-9, 1973, p. 320-324.

ABSTRACT:

This report describes a test run of the bedload pump sampling techniques on the North Arm of the Fraser River at New Westminster during the freshet of 1972. Results show that bedload sampling by pumping is feasible with resulting data more reliable than previously observed.

DATA:

Figure 2 of the report shows bedload variations for a period of 48 hours (June 28-30, 1972).

LANGLEY, H.I.
1975: Bedload Sampling by Pumping; Report, Department of Public Works Canada, Pacific Region, Marine Engineering, Vancouver, British Columbia, 72 p.

ABSTRACT:

This report summarizes the test-runs of the bedload pump sampling technique on the North Arm of the Fraser River at Vancouver during the spring freshet of 1971 and at New Westminster during the freshet of 1972.

DATA:

Secondary Source; Refer to Langley (1971, 1973).

LEGENDRE, L. et D'ANGLEJAN, B.F.
1977: Etudes sédimentologiques et géochimiques de la Baie de Rupert entre 1976 et 1977; Complex NBR - Etudes sur la Baie de Rupert, 92 p.

ABSTRACT:

Ce rapport tente de dégager les caractéristiques des dépôts sédimentaires récents et les conditions actuelles contrôlant la sédimentation dans la Baie de Rupert. Cette information est utile pour faciliter les prédictions des effets que la construction de barrages dans le complexe NBR pourrait avoir sur le régime sédimentaire et l'équilibre écologique de la baie. Seuls certains de ces effets généraux, prévisibles sur la base des données acquises au cours du bref échantillonnage effectuée de juin à août 1976, sont discutés.

DATA:

The combined suspended sediment loads of the Broadback, Nottaway and Rupert Rivers based on concentrations measured in May 1977 multiplied by the average discharges was 70 kg/sec or 2.2×10^6 tonnes/year.

LEWIS, C.P. and FORBES, D.L.
1974: Sediments and Sedimentary Processes, Yukon Beaufort Sea Coast; Task Force on Northern Oil Development, Environmental- Social Committee, Northwen Pipelines, Report No. 74-29, 40 p.

ABSTRACT:

Fieldwork in 1974 represented the third year of investigations by the Geological Survey of Canada into the geometry, composition, origin and stability of coastal landforms bordering the Beaufort Sea from the Alaska-Yukon border to Cape Dalhousie, N.W.T. The purpose of the study is to provide information which will be of use in making decisions about future development in the area.

The report is divided into two major themes: 1) the Kay Point process-response study and 2) the coastal susceptibility to oil spills.

DATA:

1) Suspended sediment concentrations during break-up flooding at B2 ranged from 50 mg/L on June 2 to less than 5 mg/L on June 6 to a maximum of 300 mg/L twelve hours after the flood peak on June 8.

2) In late June, suspended sediment concentrations were higher in Deep Creek than in the Babbage: typical values on June 19 and D3 and B4 were 100 and 10 mg/L respectively. This difference was also noted during storm floods later in the summer. Except for these floods, suspended sediment discharge decreased with water discharge through the summer, concentrations in August being generally less than 1 mg/L.

NOTE: Preliminary Data; Refer to Forbes (1981).

LISITZIN, A.P.
1972: Sedimentation in the World Ocean; Society of Economic Paleontologists and Mineralogists, Special Publication No. 17, 218 p.

DATA:

Tertiary Source.

LONG, B.F., BOUCHARD, D. and DUMAS, J.P.
1980: Etude des variations de la charge solide du fleuve Saint-Laurent entre Trois-Rivières et Gentilly, Québec; Rapport final, GREA, Département de chimie-biologie, Université du Québec à Trois-Rivières, 72 p.

ABSTRACT:

This report provides the results of surveys conducted in 1978 and 1979 on the St. Lawrence River. Variations in discharge caused by the tidal cycle, the influence of the tide wave on river flow, seasonal variation in suspended sediment concentrations and loads and variations in the suspended sediment/discharge relationship are discussed. In addition various physical/chemical parameters (temperature, pH, conductivity, carbonates, sulfates, nitrates) were monitored in order to separate the different water bodies within the river system.

DATA:

DATE	SUSPENDED-SEDIMENT LOAD
September 1978	31 900 tonnes/day
April 1979	24 100 tonnes/day

This is based on suspended sediment samples taken at 0.2, 0.6 and 0.8 the total depth at various positions along six transects.

LONG, B.F., MORISSETTE, M. and LEBEL, J.
1982: Etude du matériel particulaire en suspension et du matériel dissous des rivières Romaine et St. Jean durant un cycle saisonnier; Rapport final Institut National de Recherches Scientifiques en Oceanologie pour Hydro-Québec, contrat PC82.CE.14, 119 p.

ABSTRACT:

This study analyses the variations of the total dissolved solids (TDS) and the total suspended solids (TSS) discharge of the St. Jean and Romaine Rivers. The measurements were made before, during and after the spring flood and during the lower summer discharges.

On the St. Jean River the TSS was 2 300 t/d during the spring flood and only 130 t/d during the summer. The upper part of the basin contributes only 4% of the total input. On the Romaine River the TSS varied from 1 700 t/d down to 1 100 t/d for a river flow of 2 000 m^3/s and rivers flows of 500-1 200 m^3/s respectively. During the summer the TSS was 450 t/d (river flow of 130 m^3/s) with 50 t/d originating in the upper bassin, 40 t/d from the middle part and 360 t/d from the lower basin.

DATA:

Rivière St-Jean

	Upper Basin		Middle Basin		Lower Basin	
Date	Discharge (m^3/s)	Sediment Load (t/d)	Discharge (m^3/s)	Sediment Load (t/d)	Discharge (m^3/s)	Sediment Load (t/d)
24-25/05	-	-	42	13	366	623
26-28/05	180	67	-	153	418	1 714
03/06 (Max. Flood)	-	-	-	-	1 609	-
5-9/06	143	83	273	312	722	2 332
17-19/06	64	13	117	36	282	171
4-7/08	15	5	24	9	155	138

Rivière Romaine

	Upper Basin		Middle Basin	
Date	Discharge (m^3/s)	Sediment Load (t/d)	Discharge (m^3/d)	Sediment Load (t/d)
24/05	FROZEN	0	814	1 020
03/06	-	-	2 032	1 698
11/06	820	340	1 234	619
28/06	365	426	723	363
05/08	133	52	253	52

LUTERNAUER, J.L.
1980: Genesis of Morphologic Features on the Western Delta Front of the Fraser River, British Columbia - Status of Knowledge; IN: The Coastline of Canada, S.B. McCann, Editor. Geological Survey of Canada Paper 80-10, p. 381-396.

ABSTRACT:

Major morphologic features on the western front of the Fraser River delta include: sand swells, mud pools and dendritic drainage networks on the tidal flats; gullies (sea valleys) and sandwaves on the slope.

Low (<0.5 m), long wavelength (50-100 m) sand swells have developed extensively (a) on the northernmost flats within a V-shaped area bounded by jetties which is open to the sea and (b) adjacent to the jetty on the north side of the Main Channel. Among the northernmost swells, those on the central lowermost flats are parallel to the break in slope and appear to have formed in response to wave action alone. Swells adjacent to and paralleling the jetties formed in response to the combined effect of refracted waves and along-jetty currents. The swells adjacent to the Main Channel are parallel to the break in slope and have been sculpted by wave action. No sand swells parallel this jetty probably because channel water escaping across the structure has restricted the accumulation of sand against it.

Mud pools are forming on those parts of the upper tidal flats (a) into which fine sediment is directed, (b) where wave and current energy is low, and (c) where local depressions or shoreline configuration form traps.

Relatively fine-textured dendritic drainage networks develop primarily on the less permeable mud pools adjacent to the upper tidal flat marshes, or where eelgrass growth is dense on sandy surfaces adjacent to dredged basins or the delta slope. Network extention within one of the mud pools suggests erosion in this environment is promoted by sheetwash from the topographically higher marsh and bioturbation.

Major gullies (sea valleys) incise the delta slope off present and former channel mouths. These features may develop because of mass wasting and/or turbidity currents and may be maintained by the sliding of accumulated gully bottom sediments and the flushing action of tidal currents.

The northern section of the slope on which muds are being deposited, appears to be devoid of major bedforms, but on some parts of the sandy southern slope fields of asymmetric waves (2-3 in height; ~30 m length) extend to depths in excess of 100 m. These waves are generated primarily by flood tidal currents.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

MACDONALD, R.W.
1983: The Distribution and Dynamics of Suspended Particles in the Kitimat Fjord System; Canadian Technical Report on Hydrography and Ocean Sciences, Vol. 18, p. 116-137.

ABSTRACT:

The distribution of suspended sediments in the Kitimat fjord system has been determined during two periods; maximum and minimum runoff. The deep waters are found to have low concentrations of particulate matter (0.1 L^{-1}) and a size distribution representative of quiescent marine water. Near bottom resuspension is often found and is characterized by a predominance of fine particles. Above and within the pycnocline, flocculation processes have been identified by a loss of fine particles and formation of larger ones which disappear from the upper layer as salinity increases from 0-20%. In view of this, mixing of fresh and sea eater is expected and found to be non-conservative with respect to particulate matter. Sediment budgets estimated by a variety of techniques including particles settling, PB-210 geochronology, river input and post-glacial deposition yield a consistent picture. Most of the suspended sediments are dropped within short distances of the river mouth.

DATA:

The suspended sediment concentration of the Kitimat River is 5-15 mg/L based on direct observations (323 samples).

MATHEWS, W.H. and SHEPARD, F.P.
1962: Sedimentation of Fraser River Delta, British Columbia; Bulletin of the American Association of Petroleum Geologist, Vol. 48, No. 8, p. 1416-1443.

ABSTRACT:

The delta of Fraser River, first investigated in detail by W.A. Johnston in 1919 has been resurveyed and sampled. The slope of the delta front was found to average 1-1/2° but the upper parts off the main channel have inclinations that range mostly from 1-3/4° to 3-1/2°. Gullies occur off the main channel and these are bordered downslope by hills, both features apparently the result of landsliding on the delta front. Near the river mouth the front had advanced an average of 840 feet in 30 years at moderate depth, but appreciably less than this in shallow water. Volume of sediment added annually to the delta front is estimated to be about 700,000 x 10^6 cubic feet; silt predominates but sand is an important constituent. Delta front sediments are sandy off, and south, of the river mouth, silty on the north. Tidal movements of sediment-laden waters may account for this asymmetric distribution. Within the silty sediment the water content increases regularly with distance from the river mouth, regardless of the depth of the bottom, and the clay:silt ratio increases less markedly. Porosities and liquid and plastic limits of the freshly deposited sediments are high compared with uplifted glaciomarine and buried deltaic sediments of similar texture in the vicinity of the delta. Much exchangeable calcium and magnesium remain in the bottom sediment notwithstanding contact with sodium-rich sea water.

Recent data agree well with Johnston's estimate of 8,000 years for the age of the delta. Depth of deltaic sediment is estimated to average almost 400 feet and to range up to at least 700 feet. Environmental conditions and associated deposits on the delta top and front are summarized and the classical distinction of fore-set and bottom-set beds is not readily applicable in this example. Speculation regarding consolidation, based on laboratory and theoretical studies suggests that more than just gravitational pressure plays a part in quick compaction of the sediments of this delta.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

McCREA, J.H.
1975: Study of the Petitcodiac River Estuary; B.Sc. Report, Department of Civil Engineering, University of New Brunswick, Fredericton, New Brunswick, 69 p.

McDONALD, B.C. and LEWIS, C.P.
1973: Geomorphic and Sedimentologic Processes of Rivers and Coast, Yukon Coastal Plain. Task Force on Northern Oil Development, Environmental-Social Committee, Northern Pipelines, Report No. 73-39, 245 p.

ABSTRACT:

This report consists of a reconnaissance study of the Yukon coastal plain between the Mackenzie Delta and the Alaskan border. Emphasis was placed on collecting data pertaining to the importance of sediment erosion and accumulation, both present and potential and identifying the factors which control these processes. The report is divided into two main themes: 1) rivers and 2) coast.

DATA:

Blow River suspended sediment concentrations ranged from 0 to 4823 mg/L.

Suspended and Dissolved Sediment Loads

Study Reach	B2 Low Water	B2 Storm Surge	F2 Storm Surge
Date of Observation	1 Jul 72	27 Jun 72	17 Jul 72
Q (m^3/sec.)	73.1	183	197
C_s (mg/L)	59	2 225	4 820
$C_s + C_c$ (mg/L)	103	2 331	4 957
Q_s (kg/sec.)	7.53	427	977
Sediment Load Grain-Size Statistics:			
Per Cent Sand (>62.5 μ)	-	71.5	3.0
Per Cent Silt (1.95-62.5 <)	-	17.6	85.5
Per Cent Clay (>1.95 μ)	-	10.9	11.2
D_m (mm)	-	0.077	0.013

McLAREN, P.
1981: River and Suspended Sediment Discharge into Byam Channel, Queen Elizabeth Islands, N.W.T., Canada; Arctic, Vol. 34, No. 2, p. 141-146.

ABSTRACT:

During 1974, a stream from a small drainage basin (117 km^2) on the east coast of Melville Island discharged approximately 1.63 x 10^7 m^3 water containing 7.08 x 10^7 kg suspended sediment. Because nearby basins show hydrological similarity, these data can be extrapolated to provide an indication of the total suspended sediment discharge into the adjacent channels. The results suggest that much of this sediment is not deposited in the channels; rather it is incorporated into the active delta fronts or possibly transported out of Byam Channel above a pycnocline.

The values agree well with a hydrological study on nearby Bathurst Island where predicted discharge values for both runoff and suspended sediment are within an order of magnitude of those measured. Recent attention has focussed on the Mecham River which flows into Bridport Inlet, the site of a proposed LNG terminal which is to be situated on an active delta front. Values extrapolated from this study indicate that design criteria must considered typical runoffs of 1.2 x 10^8 m^3 with peak mean daily discharges in excess of 9.0 x 10^6 m^3/day and suspended sediment loads of 5.0 x 10^8 kg/year.

DATA:

The suspended sediment load of the Consett Head River for 1974 was 7.08 x 10^4 tonnes. This load was estimated from a rating curve based on 14 flow and suspended sediment discharge measurements.

MEADE, R.H. and PARKER, R.S.
1985: Sediment in Rivers of the United States; United States Geological Survey Water-Supply Paper 2275, p. 49-60.

ABSTRACT:

This paper reviews the general characteristics of sediment in the major rivers of the United States. The data is provided in tabular, graphical and cartographic form. It is concluded that among the issues and problems that relate to the sediment in rivers of the United States are (1) the effects of dams and reservoirs on sediment transport, (2) importance of large, infrequent storms on the generation and transport of sediment, and (3) the implications of sediment storage on the downstream movement of sediment particles and their associated contaminants. Dams and reservoirs have diminished by one-half the amount of sediment that the Mississippi River formerly transported to its delta. They have almost completely stopped the seaward transport of sediment by two other great rivers of the country, the Colorado and the Rio Grande. Until the storage of sediment in river valleys at different time scales is understood more clearly, predicting the fate of many of the pollutant substances that are found in the Nation's rivers will continue to be problematical.

DATA:

Tertiary Source.

MILLIMAN, J.D.
1980: Sedimentation in the Fraser River and its Estuary, South Western British Columbia, Canada; Estuarine and Coastal Marine Science, Vol. 10, p. 609-633.

ABSTRACT:

The Fraser River, the largest river (in terms of both water and sediment discharge) reaching the west coast of Canada, is a sand-dominated river in which most sediment transport occurs during freshet in late spring and early summer. More than half the sediment discharged during this 2-3 month period is sand. Throughout the rest of the year, the river is characterized by lower flow and low suspended sediment concentrations (primarily silt and clay); net offshore transport during these months is slight, and near-bottom transport appears to be landward.

The dominance of sand transport in the Fraser results in an estuarine depositional regime quite different from most mud-dominanted rivers and estuaries. Although most sediment in the river is carried in suspension, about 40% of the sand (20% of the total load) settles from suspension in the upper estuary and most of the rest settles prior to reaching the lower estuary.

In a natural situation, much of the river sand probably would continue moving seaward as bed load, as suggested by the prevalence of migrating sand waves in the middle estuary during freshet. Longshore drift of this sand has built tidal flats that now dominate the nearshore environment. Dredging of river channels removes an appreciable part of the total annual sand load. Jetties across intertidal flats and at the river mouth have interrupted longshore transport and increased resuspension of sand in the outer estuary by channelizing flow. All of these factors should combine in shifting tidal flats and adjacent shoreline from their natural state.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

MILLIMAN, J.D. and MEADE, R.H.
1983: World-Wide Delivery of River Sediment to the Oceans; Journal of Geology, Vol. 91, No. 1, p. 1-21.

ABSTRACT:

New data and new estimates from old data show that rivers with large sediment loads (annual discharges greater than about 15 x 10^6 tons) contribute about 7 x 10^9 tons of suspended sediment to the ocean yearly. Extrapolating available data for all drainage basins, the

total suspended sediment delivered by all rivers to the oceans is about 13.5 x 10^9 tons annually; bedload and flood discharges may account for an additional 12 x 10^9 tons. About 79% of this total is derived from southern Asia and the larger islands in the Pacific and Indian Oceans, where sediment yields are much greater than for other drainage basins.

DATA:

Tertiary Source.

NEILL, C.R. and MOLLARD, J.D.
1980: Examples of Erosion and Sedimentation Along Some Northern Canadian Rivers; Proceeding of the International Symposium on River Sedimentation, Chinese Hydraulic Engineering Society, Beijing, China, Vol. 1, p. 565-600.

ABSTRACT:

This paper provides a presentation of the factors affecting erosion and sedimentation in northern rivers. It also describes fluvial features found in northern rivers. The authors also discuss engineering problems encountered at river crossings.

DATA:

Secondary Report; Refer to Brunskill et al. (1973).

ØSTREM, G., BRIDGE, C.W. and RANNIE, W.F.
1967: Glacio-Hydrology, Discharge and Sediment Transport in the Decade Glacier Area, Baffin Island, N.W.T.; Geografiska Annaler, Vol. 49, Series A, p. 268-282.

ABSTRACT:

Mass balance studies were initiated in 1965 on the Decade Glacier near the head of Inugsuin Fiord on the eastern coast of Baffin Island. The investigation is a part of Canada's contribution to the International Hydrological Decade Program. Detailed measurements of accumulation and ablation gave average figures of 25 cm and 21 cm respectively and thus the 1965 budget was slightly positive. Discharge measurements showed a close connection between rainfall and high discharge peaks in the glacier stream, whereas periods of high air temperature gave only small rise in river discharge. A similar pattern was obtained for the Inugsuin River which drains an almost glacier-free area of 125 km^2. The bulk of the annual run-off is assumed to pass the gauging station during the summer field season, and a rough calculation based upon a provisional rating curve indicated a yearly precipitation in the order of 430 mm in the catchment area of Inugsiun River.

The sediment load was measured 2-3 times daily in the Decade River, draining 12.8 km^2 of which 8.7 km^2 (68%) is glacier-covered. In addition, a more detailed study was made once a week by sampling every 3 hours in a 24-hours period. The sediment transport showed high variations, from a few kg/day to a maximum of 1183 x 10^3 kg/day; the latter figure was observed on July 29 and it proved to be almost 60% of the total amount of suspended inorganic material moved by the river during the whole observation period.

DATA:

Decade River mean daily suspended sediment load = 30 x 10^3 kg/day.
Decade River annual suspended-sediment load = 1,972 x 10^3 kg/year.

PRETIOUS, E.S.
1969: The Sediment Load of the Lower Fraser River, B.C.; Report, Department of Civil Engineering, University of British Columbia, 27 p.

ABSTRACT:

Review of sediment transport measurements and calculations made for lower Fraser River, with attention paid to introducing techniques and bases for judgement, for the non-specialist reader.

DATA:

Refer to Water Survey of Canada Data.

PRETIOUS, E.S.
1972: Downstream Sedimentation Effects of Dams on Fraser River, British Columbia. Water Resources Series, No. 6, Department of Civil Engineering, University of British Columbia, 91 p.

ABSTRACT:

This report deals in a semi-quantitative fashion with the possible effects that dams would have on the sedimentation behaviour of the Fraser River downstream of the dams. Degradation of the river bed would undoubtedly occur until the longitudinal slope achieved a new stable value. It would ultimately be less steep than the existing slope. Retrogression of bed levels would be a maximum near the dams, depending on the erodibility of the bed, and would taper off downstream. It would be arrested wherever the bed is composed of rock, or backwater was encountered.

Peak flows, now occurring during freshets, would be eliminated downstream of any high dam or a series of dams. On the other hand, low flows would be increased, so that the river flows, resulting from regulation provided by the dams, would be more uniform throughout a year.

The detailed impact of changes in the sedimentation pattern on navigation, wildlife, and recreation, are not considered in this report. However, this report should provide some of the background material necessary in these other studies.

An effort has been made to bring to the forefront all of the available factual data on Fraser River flows and sediment loads. Theoretical evaluations have been deferred until adequate field data are available. The opinions stated in this report and the predictions which were made, leaned heavily on the accumulated factual evidence and personal experience. Recommendations for further action to obtain more complete, specific, field data have been presented.

Hoover Dam on the Colorado River has been chosen as a representative example to indicate guide lines in assessing a hypothetical Fraser River problem.

DATA:

Secondary Source; Refer to Water Survery of Canada Data.

ST-PIERRE, S. and MESSIER, D.
1983: Bilan sédimentaire des rivières Eastmain et Opinaca et évaluation de l'influence des seuils sur le transport sédimentaire; Report presented to Direction de l'Environnement de la Société d'Energie de la Baie James, 27 p.

ABSTRACT:

This study was undertaken in order to establish a sediment budget for the Eastmain and Opinaca Rivers since their regulation in 1979 and 1980. In addition, threshold values for certain physico-chemical parameters such as suspended sediment and turbidity were established.

DATA:

An estimate of 144 000 tonnes/year of suspended sediment is transported into the Eastmain River estuary. This load is based on measured concentrations in the upper reaches of the Eastmain and Opinaca Rivers and on an estimated volume of sediment derived from shore erosion.

STICHLING, W.
1973: Sediment Loads in Canadian Rivers; Proceedings of the 9th Canadian Hydrology Symposium on Fluvial Processes and Sedimentation, University of Alberta, Edmonton, May 8-9, 1973, p. 38-72.

ABSTRACT:

New development of water resources in Canada demands more and better information on hydrological and morphological processes in streams and watersheds.

This paper reviews the history of the sediment data collection program initiated in Canada in 1961, describes the latest equipment in use for measuring suspended sediment and bed load and outlines the methods used by the Water Survey of Canada for collecting and processing data. The paper compares sediment data collection technique in use in Canada with those of other countries, and also compares sedimentation conditions and sediment yield.

Because information on sediment in Canadian streams is limited, existing data were reviewed and expanded to a standard period by using existing records where these were available and estimating where records were not available. Sediment load was estimated for as many watersheds as possible by establishing a relationship between sediment load on the one hand and flow and other physiographical parameters on the other. The average suspended sediment concentration and the average suspended sediment yield per square mile per year were computed and tentative maps for these two parameters prepared.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

SUNDBY, B.
1974: Distribution and Transport of Sediment Particulate Matter in the Gulf of St. Lawrence; Canadian Journal of Earth Sciences, Vol. 11, No. 11, p. 1517-1533.

ABSTRACT:

The distribution of suspended matter was studied in the Gulf of St. Lawrence. A three-layer distribution was found. In the surface later, which was less than 50 m deep, concentrations of suspended matter ranged from 0.10 mgL^{-1} to 2.9 mgL^{-1}. A relationship to the surface circulation pattern existed with the highest concentrations occurring in the low salinity surface outflow from the estuary. In the intermediate layer, which extended down to about 50 m above bottom, the concentrations of suspended matter ranged from 0.5 mgL^{-1} to 0.1 mgL^{-1}. The intermediate layer, characterized by these concentrations, was found in the bottom layer, with highest values occurring near the estuary.

Budget calculations indicate that 5×10^6 tons/yr of suspended matter enter the Gulf from the rivers, and that erosion of the coastline and reworking of sediments are significant processes which contribute about 10.5×10^6 tons/yr of suspended matter. The net seaward transport at Cabot Strait is estimated as 5.5×10^6 tons/yr.

DATA:

The suspended sediment load at Cabot Strait is estimated as 5.0×10^6 tonnes/year. This is based on 0.1 mg/L and 0.3 mg/L being representative mean concentrations of sediment entering and leaving the Gulf of St. Lawrence respectively. It is also based on an estimate of 75×10^4 m^3/s for mean landward-transport and 84×10^4 m^3/s for mean seaward-transport.

SYVITSKI, J.P.M. and FARROW, G.E.
1983: Structures and Processes in Bay Head Deltas: Knight and Bute Inlet, British Columbia; Sedimentary Geology, Vol. 36, p. 217-244.

ABSTRACT:

Two bayhead deltas that possess similar tidal, wave and discharge characteristics are described, and their sedimentary structures, sediment character and lithofacies are compared. Although existing models predict that the two deltas should possess similar sedimentary styles of progradation, they do not. Relative to the Homathko, the Klinaklini River has a slightly larger drainage basin, steeper thalweg, and markedly greater bedload movement onto the detla. The Klinaklini has a braided deltaic morphology that develops into 30 m deep submarine channels in its prodelta environment. Except for channel gravels, the exposed deltaic facies are composed of fluvially dominated linguoid ripples of sand intermixed with climbing ripples, ladder ripples, and tidally influenced lenticular and flaser bedding. The Homathko delta has only one channel on its western flank surrounded by levee, flood plain and mouth-bar deposits dominated by the river. The eatern flank consists of wave-built sand bars transgressing landward over a tidal-influenced mudflat. The Homathko prodelta environment is extremely rugged, with steep slopes and slump scars resulting in one mega-submarine channel 140 m deep. The combination of low salinity estuarine waters and high sedimentation rates (>30 cm yr^{-1}) results in an improverished macrofauna in both deltas: physical structures can therefore be seen in environments where they are normally onliterated.

DATA:

Secondary Source: Refer to Farrow et al. (1983) and Water Survey of Canada Data.

TAMBURI, A.J.
1979: Sediment and Morphological Studies of the Lower Fraser River; Proceedings of the Fourth National Hydrotechnical Conference, Canadian Society for Civil Engineering, May 7-8, 1979, Vancouver, p. 566-581.

ABSTRACT:

Large masses of sediment, hydraulic, and sounding data were analyzed in support of navigation and environmental studies of the Lower Fraser River. The studies permitted construction of best fit equations for prediction of elements of bed material load with results which were generally superior tc a range of functions currently in the literature.

Analysis of channel morphology in conjunction with sediment data revealed that morphology and sand bedload transport are numerically related. The relations can be used for a number of pertinent tasks including:

a. as a check on flow split determinations at bifurcations;
b. to analyse the historical stability of channels;

c. to determine the flow augmentation needed for sand bed models;
d. to determine the trained width necessary for given mean or maximum depths;
e. to analyse the impact of flow divisions on channel geometry;
f. to locate areas of anomalous (non-sand) bed conditions;
g. to determine a bedload function from analysis of channel geometry.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

THOMAS, D.J., MACDONALD, R.W. and CORNFORD, A.B.
1985: Geochemical Mass-Balance Calculations for the Coastal Beaufort Sea, N.W.T., Canada; In: Contaminant Fluxes Through the Coastal Zone, No. 28, International Council for the Exploration of the Sea, 50 p.

ABSTRACT:

A geochemical mass balance approach was used to compare the natural flux of heavy metals of hydrocarbons from the Mackenzie River to the Beaufort Sea with the projected anthropogenic flux of heavy metals and hydrocarbons from proposed hydrocarbon production activities on the Beaufort Sea Shelf. Time scales and geographical scales for pollutants specific to the Mackenzie River/Beaufort Sea estuarine zone were set. The geochemical mass balance is a useful first step toward estimating possible effects of industrial activity in the coastal zone; it is within the framework of the physico-chemical estuary that bioavailability, bioaccumulation and ultimately, biological effect can be addressed.

The natural inputs to the Beaufort Sea are dominated by the Mackenzie River which delivers about 3.7×10^{11} m^3 discharge and 8.7×10^7 m^3 particulates to the shelf each year. The flushing time of the shelf is estimated at four months; the residence time for 90-95% of the river-derived particulates is about 10 days. Consequently, most of the metals and hydrocarbons derived from the river are expected to settle out on the shelf. Atmospheric deposition and coastal erosion account for less than 5% of the natural flux of metals and hydrocarbons to the area.

Projected anthropogenic sources of heavy metals and hydrocarbons to the shelf include waste drilling muds, produced water, sewage, and combustion of fueld and trash; waste drilling muds are the predominant source. The estimates for the flux of anthropogenic inputs probably represent the "worst case" because oil industry projections for oil production and the pacing of Beaufort Sea Development have recently been adjusted downward.

On a regional basis and for the production rate projected for the year 2000 (approx. 48 000 m^3 oil (300 000 bbl) per day)), the ratio of anthropogenic to natural flux is estimated at 0.002 (Ni), 0.002 (Cu), 0.009 (Zn), 0.004 (Cd), 0.06 (Hg), 0.06 (Pb), 0.008 (Cr) and 3.3 (total hydrocarbons).

A three-dimensional dispersion model with an analytical solution to the diffusion equation was used to estimate sedimentary accumulation rates and dilution of dissolved components discharged at specific locations on the shelf. The results indicate that the accumulation of metals and hydrocarbons in shelf sediments is likely to exceed natural rates of accumulation only within a 5-km zone around the discharge points. Taken into account were the large (approximately 10-fold) seasonal variation of Mackenzie River inputs; the influence of sea-ice which covers the Beaufort Sea for eight months of each year; the freshwater budget for the estuary; and the regional differences in natural sedimentation rates and particle transport.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

TYWONIUK, N.
1972: Sediment Budget of the Lower Fraser River; Paper Presented at the 13th International Conference on Coastal Engineering, Vancouver, B.C., July 10-14, 1972, 6 p.

ABSTRACT:

The Lower Fraser River, being continually developed for better navigation and larger port facilities, is an area of active sedimentation. The dynamic processes influenced by river discharge, tides and winds are probably the most important factors in the transport and deposition of sediments in the estuary. The main part of the Fraser Estuary is vertically homogeneous (non-stratified) and the sediments are transported progressively seaward and are accumulated near the limit of net landward flow. The lower estuary is stratified and coarse sediments are trapped near the toe of the salt wedge while the fine sediments are carried seaward with the outflowing river water.

The hydrometric and sediment survey of the lower Fraser River are described. Survey results are used in determining the sediment balance of the river reach. In the budget analysis, the river and estuary are divided into four consecutive reaches, the sediment discharges are subdivided to represent about 10 particle size ranges and the balance is then determined for each reach and particle size range.

Conclusions are drawn with respect to the sediment transport and depositional characteristics, annual variations, and the agreement between the sediment entering the estuary and the sediment dredged.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

TYWONIUK, N.
1973: Sediment Budget of the Lower Fraser River; Proceedings of the 9th Canadian Hydrology Symposium on Fluvial Processes and Sedimentation, University of Alberta, Edmonton, May 8-9, 1973, 15 p.

ABSTRACT:

The Lower Fraser River, being continually developed for better navigation and larger port facilities, is an area of active sedimentation. The dynamic processes influenced by river discharge, tides and winds are probably the most important factors in the transport and deposition of sediments in the estuary. The main part of the Fraser Estuary is vertically homogeneous (non-stratified) and the sediments are transported progressively seaward and are accumulated near the limit of net landward flow. The lower estuary is stratified and coarse sediments are trapped near the toe of the salt wedge while the fine sediments are carried seaward with the outflowing river water.

The sediment balance of the lower Fraser River, as a result of both natural and man-induced dynamic processes, is represented factually by means of a sediment budget. In this analysis, the river and estuary are divided into four consecutive reaches, the sediment discharges are subdivided to be representative of several particle size ranges and the balance is then determined for each reach and particle size range. The budget is based on five years of continuous data (hydrometric, suspended sediment and bedload data) at four stations on the main channel of the Lower Fraser River and at five tributaries and on miscellaneous data in other parts of the estuary.

An attempt is made to interpret some of the results and to identify and describe the causative factors. Finally, conclu- sions are drawn with respect to the transport and depositional characteristics, annual variations, and the agreement between the sediment entering the estuary and the sediment dredged.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

TYWONIUK, N. and STICHLING, W.
1973: Sedimentation Phenomenon of the Fraser River; Proceedings of the International Symposium on River Mechanics, International Association for Hydraulic Research, Bangkok, Thailand, Vol. 1, Paper A-69, p. 805-818.

ABSTRACT:

The Lower Fraser River is an area of active sedimentation. The dynamic processes influenced by river discharge, tides and winds are probably the most important factors in the transport and deposition of sediments in the estuary.

The sedimentation phenomenon of the lower Fraser River is described and illustrated in this paper. The time variations of flow, suspended sediment transport and bedload transport are first illustrated. The

sediment belance of the river reach is subsequently shown for four consecutive reaches. Finally, conclusions are drawn with respect to the transport and depositional characteristics, annual variations and the agreement between the sediment entering the estuary and the sediment dredged.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

WEDEL, J.H., THORNE, G.A., BARACOS, P.C,
1977: Site-Intensive Hydrologic Study of a Small Catchment on Bathurst Island; Interim Report, 1977, Hydrologic Regimes, Freshwater Project No. 1, Inland Waters, Western and Northern Region, 124 p.

SUMMARY:

The Snowbird Creek study lies in the eastern segment of a surficially active zone of loosely consolidated sandstones and other sedimentaries mantled by a regolith of sandy silt which is susceptible, in the High Arctic environment, to considerable mass movement and fluvial erosion.

Other investigators of arctic hydrology (Holecek and Vosahlo, 1975; Cogley and McCann, 1975; Rannie, 1976) have derived basin water budgets, one common method of assessing the hydrologic parameters of small catchments. Their research suggests that meteorological parameters - most notably snow precipitation data and the amount of snow available for melt in June or July of the succeeding summer - are the principal reasons for imbalance in their budgets. Since our goal was similar, the study group made snow surveys prior to runoff in June. Mean value for water content of snow on the ground on June 19 was 117 millimetres. Areal snow regression was computed from Landsat imagery, two sets of high and low level aerial photography, a second snow survey, and by chronologically sequenced ground photos. Linear regressions on meteorological data related to snowmelt runoff generated a moderately successful, empricial model.

Rainfall was light - a total of 19 millimetres (mm) for the period starting May 29 and ending August 28. Calculated runoff for Snowbird Creek was 156 mm, and for Whitebear Creek,* 136 mm. Analyses of the discharge hydrographs indicates some groundwater contribution to runoff from the active layer, or from meltwater from deep snowbeds for the period July 24 to July 30. It appears likely that condensation contributes measurable input into the water budget. Calculations for condensation on snow surfaces alone indicate 4 mm of input as a mean value over the basin. Snowfall from June 19 to August 30 represents an ungauged precipitation value.

For pipeline investigations it is apparent that a satisfactory computation of surface runoff is only an input into the measurement of sediment transport, erosion, and degradation-aggradation. Accordingly, data was assembled for bed material, suspended and dissolved sediment

discharge for the main site on Snowbird Creek and the tributary site on Whitebear Creek. For Snowbird, the total load was computed as 1,983 tonnes/year, and for Whitebear as 244 tonnes/year. Hysterisis in the plot of sediment concentrations was apparent - the heaviest concentrations occurring with the first substantial runoff on July 4. Maximum concentrations measured were in the order of 1,300 parts per million (ppm) and 1,100 ppm for Snowbird and Whitebear respectively. Deposition of sediments in the main channel by early rill and gully flow prior to principal channel activity, and the highly uncohesive fabric of newly-thawed silty regolith are two factors advanced to explain the effect. Mass movement downslope was measured at three sites. Only one showed instability in 1976; maximum movement was 16 centimetres (cm.) in the period July 8 to August 29.

On Glacier Creek, a small tributary to Snowbird Creek, a substantial slushflow, similar to that described by Washburn (1973) at Mesters Vig, moved quantities of coarse material considerable distances. Although 1958 aerial photography does not indicate the presence of perennial snowbeds in this valley, accumulations of ice, firn and new snow containing sediment strate suggest that the present accumulation is several years old.

Cross-channel excavations necessary to lay a pipeline underneath a streambed would not appear to generate sufficient spoil material to seriously affect the sediment regimes of similar rivers. The point is made, however, that any ditching cross-channel would have the least effect on river sediment regimes if it were done downstream of ecologically sensitive areas rather than in headwater reaches of a basin, where every rill and gully would be supplied with additional sediment for transport.

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*Locally named by investigators during summer of 1976.

DATA:

SNOWBIRD CREEK - BED SEDIMENT DISCHARGE 1976
Daily Mean Values (Tonnes/Day)

Day	June	July	August
1		1.2	
2		0.6	
3		12.0	
4		24.7	
5		20.9	
6		14.2	
7		3.8	
8		3.4	0.2
9		4.7	0.1
10		5.7	
11		1.7	
12		.8	
13		1.7	
14		5.7	
15		1.8	
16		1.9	
17		1.9	
18		6.1	
19		10.7	
20		9.1	
21		5.5	
22		3.7	
23		2.6	
24		1.3	
25	0.2	1.1	
26	0.2	0.8	
27	0.2	1.5	
28	1.3	1.1	
29	0.7	0.5	
30	0.4	0.2	
31	x	0.1	
Total	3.0	150.0	0.3

Total for Period - 153 tonnes

SNOWBIRD CREEK - SEDIMENT DISCHARGE 1976
Daily Mean Values (Tonnes/Day)

Day	June	July	August
1		10.6	0.76
2		10.1	1.19
3		31.4	0.58
4		238	0.50
5		190	0.47
6		23.4	0.38
7		2.58	0.65
8		12.0	1.83
9		59.5	1.99
10		34.7	0.56
11		2.18	0.60
12		.69	0.43
13		1.48	0.01
14		34.2	0.02
15		26.3	0.03
16	16.5	0.02	
17		23.2	0.05
18		71.2	0.56
19		119	0.87
20		185	0.14
21	.04	122	0.001
22	.24	54.0	0.004
23	.08	40.4	0.003
24	.52	17.4	0.002
25	2.41	13.8	0
26	1.59	26.5	0
27	3.76	56.9	0
28	23.7	27.5	0.001
29	10.4	18.4	0
30	6.84	7.45	0
31	x	4.04	0
Total	49.58	4.04	0

Total for Period - 1560 Tonnes

WHITEBEAR CREEK - SEDIMENT DISCHARGE 1976
Daily Mean Values (Tonnes/Day)

Day	June	July	August
1		0.40	1.1
2		0.52	1.0
3		21.0	.84
4		4.70	.59
5		4.40	.39
6		1.40	.18
7		0.64	.31
8		1.70	.51
9		2.10	.99
10		0.74	.59
11		0.35	.33
12		0.21	.33
13		1.1	.33
14		9.6	.07
15		3.5	.18
16		2.0	.07
17		3.2	.07
18		13.1	.04
19		13.5	.08
20		22.9	.09
21		14.1	.02
22		12.8	.01
23		8.5	
24		4.2	
25		5.3	
26		8.5	
27		9.4	
28	0.25	4.6	
29	0.80	4.4	
30	1.05	2.9	
31	x	2.4	
Total	2.1	184.16	8.12

Total for Period - 194 tonnes

WESTERN CANADA HYDRAULIC LABORATORIES LTD.
1977: Analysis of Lower Fraser River Sediment Data; Interim Report to Water Survey of Canada, 44 p.

ABSTRACT:

Processing of Water Survey of Canada sediment and flow data taken on the Lower Fraser River is completed, and bivariate relations are derived for sediment variables as a function of flow variables.

The bivariate data analysis is used to explore the overall quality of the data collected at each station for various flow conditions, and to determine what further data analysis is appropriate for the available data. Preliminary sediment rating equations are also provided for each of the sediment transport components, and the predictive value of measured, and derived hydraulic variables is evaluated.

An assessment is made of the techniques and sites used for the data collection, and recommendations for improvements in data collection procedures are suggested.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

WESTERN CANADA HYDRAULIC LABORATORIES LTD.
1978: Analysis of Federal Sediment Survey Data Taken on the Lower Fraser River; Final Report to Water Survey of Canada, 123 p. + Appendices.

ABSTRACT:

Processing of Water Survey of Canada sediment and flow data taken on the Lower Fraser River is completed, and initial bivariate relations were derived for sediment variables as a function of flow variables.

The bivariate data analysis was used to explore the overall quality of the data collected at each station for various flow conditions, and to determine what further data analysis was appropriate for the available data.

At Mission and Agassiz multivariate predictive equations are developed for total bed material load. Riveriate predictive equations are also generated for Mission suspended D_{50} and $\emptyset$, making it possible to predict suspended load tonnage by size fraction at that station.

Equations derived from field data at Mission and Agassiz are compared with a selection of mathematical functions in the literature. On the basis of the comparison and statistical tests of the results sediment transport is assessed at each station, and from station to station.

The utility of regime analysis is investigated for prediction of sediment transport. A clear relation is found between bedload transport conditions and elements of channel geometry.

Changes in sediment size are examined and assessed from Hope to the Straits of Georgia.

An assessment is made of the techniques and sites used for data collection, and recommendations for improvements in data collection procedures are suggested.

Finally, all existing delta data are analyzed, collated, and examined for tidal and discharge dynamics.

WINTERS, G.V.
1981: Environmental Geology of the Miramichi Estuary: Suspended- Sediment Transport. Geological Survey of Canada, Paper 81.16, 12 p.

ABSTRACT:

The temporal and spatial distribution of suspended sediment in he Miramichi inner estuary has been studied and a polynomial model was used to estimate the annual residual transport of suspended sediment. Suspended sediment concentrations varied from 0.5 to 90 mg L^{-1} in May and from 0.1 to 80 mg L^{-1} in February, and were primarily derived from tidal current resuspension of bottom sediments during times of low river discharge. Suspended sediment transport has been modelled using water transport which is shown to be a function of the tidal oscillation and river discharge. A diurnal inequality in the semidiurnal tides and variation in river discharge (50 m^3 s^{-1} in January to 1700 m^3 s^{-1} in May) resulted in a continual inequality in the suspended sediment transports for individual flood and ebb tides. Tidal transport generally varied from 30 to 300 metric tonnes, however 3000 metric tonnes can be exported on a single ebb tide during a high river discharge period. The model accounts for long cyclic changes which are included in observed tide gauge and river discharge observations. Model estimates for the 1976 annual residual transport agree with sedimentation rates estimated from care samples.

DATA:

The annual suspended-sediment transport into the Miramichi estuary for 1976 was estimated as 90-100 x 10^3 tonnes. This estimate is based on a polynominial model which takes into account 1) tidal circulation only, 2) one-layer estuarine circulation during both ebb and flood cycles and 3) two-layer estuarine circulation during flood cycles and one-layer circulation during ebb cycles.

WINTERS, G.V.
1983: Modeling Suspended Sediment Dynamics of the Miramichi Estuary, New Brunswick, Canada; Canadian Journal of Fisheries and Aquatic Sciences, Vol. 40, Suppl. 1, p. 105-116.

ABSTRACT:

Polynomial models were used to estimate the annual transport of suspended sediment in an estuary with a variable salt-wedge. The

models are empirical, based on water flux measurements and SPM concentration, and these are shown to be a function of the tidal oscillations and river discharge.

The Miramichi River discharge varies from about 50 $m^3 \cdot s^{-1}$ in January to 1700 $m^3 \cdot s^{-1}$ in April. Diurnal inequality in the semidiurnal tides and variation in river discharge produces a continual inequality in the suspended sediment (SPM) transports for individual flood and ebb tides. Consequently, the models rely on integrating observations for each flood and ebb cycle. Empirical data indicate that semidiurnal tidal transport generally varies from 30 to 300 t in either ebb or flood direction. However, an order of magnitude increase can occur when the ebb tide couples with high runoff (i.e. 3300 t during a single ebb cycle in May 1976). A two-layer model gives a small (20%) increase in the residual sediment transport compared to a one-layer model. The 1976 net transport was calculated as -100 000 t (seaward). Sedimentation rates estimated from core samples agree with model estimates.

DATA:

Secondary Source; Refer to Winters (1981).

ZRYMIAK, P. and DURETTE, Y.J.
1979: An investigation of the Morphological Processes Occurring in the Squamish River Estuary; Unpublished Paper Presented for the Fourth National Hydrotechnical Conference, May 7-8, 1979, Vancouver, British Columbia, 15 p.

ABSTRACT:

In 1972, a long term morphological study of the Squamish River Estuary was undertaken by the Department of the Environment as a joint project between the Sediment Survey Section of the Applied Hydrology Division, Ottawa and the Water Survey of Canada, Pacific Region.

The objective of the study was to monitor the impact of water diversion and dredging on the Lower Squamish River Estuary.

The area under investigation consists of approximately a five kilometre stretch of the Lower Squamish River. The data necessary to determine estuarine sedimentation rates and distribution was collected through the use of the HYDAC-100 and reduced using the HYDRA computation system.

The variety of formats in which the results are available through the use of the Hydac and Hydra systems, as shown in this paper, greatly simplifies the task of evaluating estuarine regime alterations. This evaluation showed the upper portion of the surveyed reach to be stable. The central portion is undergoing significant changes on the northwest bank, while the face of the delta is advancing at a steady rate. This advance will probably extend across the mouth of the proposed harbour.

DATA:

Secondary Source; Refer to Water Survey of Canada Data.

APPENDIX 1

DATA TABLES

ATLANTIC DRAINAGE WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
1	NS	Annapolis River at Wilmot (01DC005)	546	18	1967	16	33.2	17	1 470	2.7	Bay of Fundy
					1968	103	12.7	11	4 587	8.4	
					1969	81	11.4	9	3 237	5.9	
					1970	77	9.8	9	2 927	5.4	
					1971	99	14.9	9	4 093	7.5	
					1972	109	17.6	10	5 373	9.8	
					1973	106	14.2	13	6 020	11.0	
					1974	88	13.6	11	4 861	8.9	
					1975	69	12.3	11	4 107	7.5	
					1976	65	15.9	15	7 573	13.9	
					1977	75	17.5	11	5 903	10.8	
					1978	55	9.3	13	3 928	7.2	
					1979	63	18.5	15	8 535	15.6	
					1980	54	9.5	12	3 471	6.4	
					1981	65	15.6	11	5 198	9.5	
					1982	64	10.5	10	3 328	6.1	
					1983	83	9.1	14	3 949	7.2	
					1984	67	10.8	12	4 206	7.7	
						Mean:	14.2	12	4 598	8.4	
					Standard Deviation:		5.6	2	1 679	3.1	
2	QUE	Bic (Rivière du) (020A026)	191	3	1970-72*	-	-	-	-	-	St. Lawrence Estuary
3	PEI	Brudenell River at Brudenell (01CE004)	33.1	6	1979	36	0.9	69	997	30.1	Gulf of St. Lawrence
					1980	51	0.8	23	564	17.0	
					1981	60	0.9	25	665	20.1	
					1982	62	0.9	11	303	9.2	
					1983	103	0.8	14	349	10.6	
					1984	121	0.9	17	507	15.3	
						Mean:	0.9	27	564	17.0	
					Standard Deviation:		0.1	21	251	7.6	

* Miscellaneous Data Only

ATLANTIC DRAINAGE WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
4	PEI	Brudenell River near Brudenell (01CE003)	36.0	14	1966	33	0.4	12	74	2.1	Gulf of St. Lawrence
					1967	78	0.9	24	680	18.9	
					1968	61	0.9	52	1 408	39.1	
					1969	60	0.7	35	813	22.6	
					1970	50	0.6	17	316	8.8	
					1971	69	1.0	15	459	12.8	
					1972	66	0.8	53	1 272	35.3	
					1973	37	0.8	18	434	12.1	
					1974	52	0.7	26	578	16.0	
					1975	66	0.7	43	980	27.2	
					1976	99	0.8	11	726	20.2	
					1977	120	1.0	17	544	15.1	
					1978	114	0.8	11	285	7.9	
					1979	40	0.9	38	204	5.7	
						Mean:	0.8	28	627	17.4	
					Standard Deviation:		0.2	14	389	10.8	
5	QUE	Dauphine (Rivière) (02PE014)	24.9	1	1972*	-	-	-	-	-	St. Lawrence Estuary
6	PEI	Dunk River at Wall Road (01CB002)	114	2	1974	54	1.6	38	1 295	11.4	Northumberland Strait
					1975	106	2.0	29	1 048	9.2	
						Mean:	1.8	34	1 172	10.3	
					Standard Deviation:		0.2	6	175	1.6	
7	QUE	Etchemin (Rivière) à Saint-Henri (02PH009)	1 410	2	1980-81*		-	-	-	-	St. Lawrence Estuary
8	NFLD	Harrys River below Highway Bridge (02YJ001)	640	6	1979	31	30.4	1	1 035	1.6	St. George's Bay
					1980	57	25.0	5	3 827	6.0	
					1981	68	26.4	6	4 900	7.7	
					1982	100	30.8	8	7 828	12.2	
					1983	103	26.6	11	9 451	14.8	
					1984	64	26.7	11	9 669	15.1	
						Mean:	27.7	7	6 118	9.6	
					Standard Deviation:		2.4	4	3 441	5.4	

* Miscellaneous Data Only

ATLANTIC DRAINAGE - WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
9	NFLD	Highlands River at Trans-Canada Highway (02ZA002)	72.0	3	1982	58	3.4	11	1 128	15.7	St. George's Bay
					1983	64	3.4	18	1 915	26.6	
					1984	59	2.5	12	948	13.2	
						Mean:	3.1	14	1 330	18.5	
					Standard Deviation:		0.5	4	514	7.1	
10	NS	Kelley River (Mill Creek) at Eight Mile Ford (01DL001)	63.2	14	1971	165	1.9	4	251	4.0	Chinecto Bay
					1972	234	2.6	11	936	14.8	
					1973	151	1.4	5	143	2.3	
					1974	24	1.4	9	189	3.0	
					1975	51	1.9	9	530	8.4	
					1976	53	2.4	9	686	10.8	
					1977	50	2.7	6	548	8.7	
					1978	52	1.6	5	264	4.2	
					1979	53	2.6	7	551	8.7	
					1980	48	1.8	5	272	4.3	
					1981	50	2.3	7	481	7.6	
					1982	45	1.9	3	200	3.2	
					1983	58	2.0	3	207	3.3	
					1984	73	1.6	4	174	2.8	
						Mean:	2.0	6	388	6.1	
					Standard Deviation:		0.5	3	237	3.7	
11	NS	Kennebecasis River at Apohaqui (01AP004)	1 100	19	1966	39	7.9	12	1 468	1.3	St. John River (Bay of Fundy)
					1967	139	30.6	32	31 044	28.2	
					1968	137	21.4	38	25 919	23.6	
					1969	163	21.7	28	19 504	17.7	
					1970	151	20.8	64	41 944	38.1	
					1971	153	24.0	37	28 322	25.7	
					1972	154	29.7	47	43 877	39.9	
					1973	153	27.0	40	34 394	31.3	
					1974	134	23.5	63	46 258	42.1	
					1975	118	23.9	33	24 982	22.7	
					1976	127	31.4	35	34 821	31.7	
					1977	156	33.1	44	45 712	41.6	
					1978	109	23.9	31	23 564	21.4	
					1979	201	40.2	49	62 312	56.7	
					1980	215	24.2	26	19 578	17.8	
					1981	210	40.2	55	69 243	62.9	
					1982	192	24.6	31	23 691	21.5	
					1983	205	25.4	31	24 709	22.5	
					1984	181	28.3	49	43 669	39.7	
						Mean:	26.4	39	33 951	30.9	
					Standard Deviation:		7.2	13	15 908	14.5	

* Miscellaneous Data Only

ATLANTIC DRAINAGE - WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
12	NB	Little Southwest Miramichi River at Lyttleton (01BP001)	1 340	1	1975	42	59.2	18	11 064	8.3	Miramichi River (Miramichi Bay)
13	QUE	Loup (Rivière du) à la route no. 232 (02PG001)	1 040	12	1968 81*						St. Lawrence Estuary
14	NS	Middle River at Rocklin (01DP004)	92.2	16	1969	13	2.9	20	776	8.4	Northumberland Strait
					1970	45	2.2	12	796	8.6	
					1971	43	3.2	14	1 427	15.5	
					1972	63	3.8	15	1 814	19.7	
					1973	56	2.8	8	695	7.5	
					1974	41	3.0	17	1 601	17.4	
					1975	31	2.4	13	940	10.2	
					1976	38	2.8	10	874	9.5	
					1977	17	3.2	5	478	5.2	
					1978	29	2.1	5	315	3.4	
					1979	52	3.9	12	1 449	15.7	
					1980	36	2.4	13	987	10.7	
					1981	28	2.8	8	486	5.3	
					1982	25	1.7	5	193	2.1	
					1983	15	2.7	6	334	3.6	
					1984	131	2.7	8	687	7.5	
						Mean:	2.8	11	866	9.4	
					Standard Deviation:		0.6	5	484	5.3	
15	NFLD	Northeast Brook near Roddickton (02YD002)	200	4	1981	28	5.2	11	919	4.6	Canada Bay
					1982	58	5.8	8	1 524	7.6	
					1983	87	4.6	8	1 134	5.7	
					1984	61	4.7	10	1 517	7.6	
						Mean:	5.1	9	1 273	6.4	
					Standard Deviation:		0.6	2	298	1.5	

* Miscellaneous Data Only

ATLANTIC DRAINAGE - WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/l)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
16	NFLD	Northeast Pond River at Northeast Pond (02ZM006)	3.9	9	1970	54	0.2	6	29	7.5	Conception Bay
					1971	56	0.1	2	9	2.4	
					1972	74	0.1	3	13	3.3	
					1973	90	0.1	3	12	3.2	
					1974	77	0.1	3	12	3.1	
					1975	80	0.1	3	9	2.4	
					1976	84	0.1	3	12	3.1	
					1977	67	0.1	3	9	2.4	
					1978	59	0.1	2	8	2.1	
						Mean:	0.1	3	13	3.3	
					Standard Deviation:		0.0	1	6	1.7	
17	NB	Northwest Miramichi River at Trout Brook (01BQ001)	948	1	1975	34	44.7	11	5 295	5.6	Little Southwest Miramichi River (Miramichi Bay)
18	NB	Palmers Creek near Dorchester (01BU004)	34.2	8	1967	4	1.5	13	52	1.5	Chinecto Bay
					1968	71	0.9	19	550	16.1	
					1969	71	0.7	14	314	9.2	
					1970	81	0.7	13	307	9.0	
					1971	68	1.1	17	556	16.3	
					1972	67	1.2	25	954	27.9	
					1973	94	0.8	15	393	11.5	
					1974	71	0.8	21	552	16.1	
						Mean:	1.0	17	460	13.5	
					Standard Deviation:		0.3	4	263	7.7	
19	NS	Pembroke River at Glenbervie (01DG018)	73.3	7	1978	33	1.7	4	193	2.6	Stewiacke River (Cobequid Bay)
					1979	89	3.2	6	618	8.4	
					1980	91	2.2	7	464	6.3	
					1981	87	2.6	7	535	7.3	
					1982	92	2.2	5	352	4.8	
					1983	109	2.6	5	407	5.6	
					1984	73	2.0	9	574	7.8	
						Mean:	2.3	6	449	6.1	
					Standard Deviation:		0.5	2	146	2.0	

* Miscellaneous Data Only

ATLANTIC DRAINAGE - WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
20	NB	Petitcodiac River Near Petitcodiac (01BU002)	391	17	1967	3	16.4	18	777	2.0	Chinecto Bay
					1968	69	8.1	18	4 651	11.9	
					1969	95	5.8	15	2 796	7.2	
					1970	64	5.7	13	2 363	6.0	
					1971	78	7.9	18	4 362	11.2	
					1972	147	9.5	19	5 726	14.6	
					1973	124	9.2	13	3 900	10.0	
					1974	150	8.5	28	7 589	19.4	
					1975	106	8.2	25	6 332	16.2	
					1976	122	9.7	22	6 775	17.3	
					1977	147	10.4	20	6 382	16.3	
					1978	103	6.3	18	3 637	9.3	
					1979	137	13.6	24	10 189	26.1	
					1980	116	7.7	22	5 507	14.1	
					1981	93	11.7	23	8 605	22.0	
					1982	71	8.0	20	4 973	12.7	
					1983	51	7.2	24	5 362	13.7	
						Mean:	9.1	20	5 290	13.5	
					Standard Deviation:		2.8	4	2 321	5.9	
21	QUE	Rimouski (Rivière) (02QA002)	1 590	6	1968 73*		-	-	-	-	St. Lawrence Estuary
22	QUE	Saint Laurent (Fleuve) à LaSalle (02QA016)		8	1967	1	9 666.0	1	344 450		Gulf of St. Lawrence
					1968	62	8 250.0	8	2 213 930		
					1969	60	9 050.0	9	1 851 964		
					1970	97	8 430.0	8	2 145 875		
					1971	114	8 530.0	7	1 870 668		
					1972	89	9 590.0	9	2 611 774		
					1973	75	10 700.0	10	2 057 099		
					1974	71	10 400.0	13	3 650 560		
					1975*		8 480.0				
						Mean:	9 232.2	9	2 092 290		
					Standard Deviation:		903.4	2	916 420		
23	QUE	Saint Laurent (Fleuve) à la ville de Québec (02PD003)		3	1973 75*		-	-	-	-	Gulf of St. Lawrence

* Miscellaneous Data Only

ATLANTIC DRAINAGE WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
24	NB	Saint John River Below Mactaquac (01AK004)	39 900	3	1966	63	632	37	186 480	4.7	Bay of Fundy
					1967	68	686	22	434 205	10.9	
					1968	23	2 100	4	39 687	1.0	
						Mean:	1 139	21	220 124	5.5	
					Standard Deviation:		832	17	199 399	5.0	
25	QUE	Sainte-Anne (Rivière) du Nord à la Centrale de Saint-Fereol (02PE001)	974	3	1971-73*	-	-	-	-	-	St. Lawrence Estuary
26	NS	Salmon River at Murray (01DH002)	363	6	1967	4	16.9	15	690	1.9	Cobequid Bay
					1968	53	8.8	28	7 783	21.4	
					1969	49	9.7	25	7 688	21.2	
					1970	54	9.1	9	2 630	7.2	
					1971	62	12.9	19	7 765	21.4	
					1972	134	13.9	24	10 582	29.2	
						Mean:	11.9	20	6 190	17.1	
					Standard Deviation:		3.2	7	3 728	10.3	
27	NS	Salmon River at Salmon River Bridge (01FJ001)	199	2	1976*		7.3	-	-	-	Mira River (Mira Bay)
					1977	30	8.5	19	2 575	12.9	
28	PEI	Smelt Creek near Ellerslie (01CA004)	17.3	7	1967	11	0.4	12	31	1.8	Cascumpec Bay
					1968	51	0.3	14	124	7.2	
					1969	39	0.3	7	64	3.7	
					1970	49	0.3	10	88	5.1	
					1971	47	0.5	18	265	15.3	
					1972	66	0.6	20	377	21.8	
					1973*		0.6	-	-	-	
						Mean:	0.4	14	158	9.1	
					Standard Deviation:		0.1	5	135	7.8	
29	NB	Southwest Miramichi River at Blackville (01B0001)	5 050	2	1975	37	216.0	8	18 848	3.7	Miramichi River (Miramichi Bay)
					1984	52	160.0	8	30 699	6.1	
						Mean:	188.0	8	24 774	4.9	
					Standard Deviation:		39.6	0	8 379	1.7	

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ATLANTIC DRAINAGE - WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/l)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
30	QUE	Sud (Rivière du) à Arthurville (02PH010)	821	4	1971-74*	-	-	-	-	-	St. Lawrence Estuary
31	NFLD	Waterford River at Kilbride (02ZM008)	52.7	7	1978	20	1.5	10	308	5.9	Atlantic Ocean
					1979	24	2.4	25	1 893	35.9	
					1980	33	2.7	28	2 385	45.2	
					1981	75	2.5	40	3 172	60.2	
					1982	110	2.3	18	1 323	25.1	
					1983	172	2.0	18	1 173	22.3	
					1984	94	2.2	15	1 079	20.5	
						Mean:	2.2	22	1 619	30.7	
					Standard Deviation:		0.4	10	946	17.9	

* Miscellaneous Data Only

ATLANTIC DRAINAGE - SPECIFIC STUDIES

Map #	Province	Reference	River	Study Year	Suspended Sediment Concentration (mg/L)	Bedload (tonnes)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
32	Nova Scotia	Amos (1976)	Herbert River	1975			650 0.5-20 t/day		Cobequid Bay
33	Nova Scotia	Amos and Joice (1977)	Herbert River	09/75-12/75 05/76-07/75			261.7 151.4		Cobequid Bay
34	Québec	d'Anglejan (1969)	St. Lawrence R. (Cabot Strait)	1967-1968			1 000 000		Gulf of St. Lawrence
35	Québec	d'Anglejan and Smith (1973)	St. Lawrence River	1971-1972			0.5-0.6x10^6		Gulf of St. Lawrence
36	Québec	Camotim and Frenette (1979)	Romaine River	23-05-78 09-06-78 13-09-78	39,7 8,7 1,0		5 285 t/day 822 t/day 17 t/day		St. Lawrence River
37	Québec	Canada (1969)	St. Lawrence R. (Les Grèves Section)	17-10-69 06-10-69 07-10-69		 2.2 t/day 2.0 t/day	11 428 t/day		Gulf of St. Lawrence
			St. Lawrence R. (Chenal aux Corbeaux Section)	29-10-69 30-10-69 29-10-69 30-10-69		 1.2 t/day 0.5 t/day	1 633 t/day 989 t/day		
38	Québec	Canada (1970)	St. Lawrence R. (Les Grèves Section)	29-05-70 02-06-70 03-06-70			12 154 t/day 18 321 t/day 17 777 t/day		Gulf of St. Lawrence

ATLANTIC DRAINAGE - SPECIFIC STUDIES

Map #	Province	Reference	River	Study Year	Suspended Sediment Concentration (mg/L)	Bedload (tonnes)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
39	Québec	Catalliotti Valdina and Long (1983)	St. Jean River	1980		(flood) 18.2 t/day (summer)	2 070 t/day	River	St. Lawrence
40	Québec	Catalliotti Valdina and Long (1984)	Rivière aux Outardes	1980 6,9 16,1			85 462 t/day 57 506 t/yr		St. Lawrence River
41	Québec	Centreau (1984)	St. Lawrence R. (Varennes Montmagny Section)	1973			17 000 50 000 t/day		Gulf of St. Lawrence
42	Québec	Couillard (1982)	St. Lawrence R.	1970 1973					Gulf of St. Lawrence
			1) Ile D'Orleans to Ile aux Coudres		40 8 (mean)				
			2) Rivière du Loup (City)		5 (mean)				
			3) Saguenay River (Mouth)		2 (mean)				
			4) East of Saguenay River		≤1 (mean)				
			Gulf of St. Lawrence						
			1) Laurentian Trough		0,6 0,8 (mean)				
			2) Gulf (Mean)		≤ 1,0 (mean)				

ATLANTIC DRAINAGE SPECIFIC STUDIES

Map #	Province	Reference	River	Study Year	Suspended Sediment Concentration (mg/L)	Bedload (tonnes)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
43	Québec and Ontario	Frenette and Larinier (1973)	St. Lawrence R.	1968-1972					
			1) Outlet of Lake Ontario				1 633 t/day		Gulf of St. Lawrence
			2) Cornwall (City)				4 807 t/day		
			3) Outlet of Lake Louis				3 900 t/day		
			4) Varennes				5 079 t/day		
			5) Mercier Bridge (Montreal)				6 349 t/day or 2.3×10^6 t/yr		
			6) Québec (City)				10 884-13 605 t/day or 4.5×10^6 t/yr		
44	Québec	Long et al. (1980)	St. Lawrence R. (Trois-Rivières - Gentilly Section)	09-1978			31 900 t/day 24 100 t/day		Gulf of St. Lawrence
45	Québec	Long et al. (1982)	St. Jean River Romaine River	1981			138-2 332 t/day 52-1 698 t/day		St. Lawrence R. St. Lawrence R.
46	Québec	Sundby (1974)	St. Lawrence R. (Gulf at Cabot Strait)	1973			5 000 000		Gulf of St. Lawrence
47	New Brunswick	Winters (1981)	Miramichi River	1976			90 000-100 000		Miramichi Bay

ARCTIC DRAINAGE - WATER SURVEY OF CANADA DATA
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48	NWT	Abbott River above Midshipman Bay (10ICO16)	191	1	1975*			-	-	-	Midshipman Bay
49	ONT	Abitibi River at Onakawana (04MJ003)	27 500	2	1978*		643.0	-	-	-	Moose River (James Bay)
					1983*		563.0	-	-	-	
						Mean:	603.0	-	-	-	
					Standard Deviation:		56.6	-	-	-	
50	ONT	Albany River near Hat Island (04HA001)	118 000	8	1975*		1 960.0	-	-	-	James Bay
					1976*		2 560.0	-	-	-	
					1977*		1 010.0	-	-	-	
					1978*		922.0	-	-	-	
					1980*		325.0	-	-	-	
					1981*		802.0	-	-	-	
					1982*		2 580.0	-	-	-	
					1983*		1 560.0	-	-	-	
						Mean:	1 464.9	-	-	-	
					Standard Deviation:		839.8	-	-	-	
51	NWT	Allen River near the mouth (10ICO01)	448	1	1975*		5.2	-	-	-	Allen Bay
52	NWT	Aston River above Aston Bay (10ID004)	961	1	1975*			-	-	-	Aston Bay
53	ONT	Attawapiskat River below Muketei River (04FC001)	36 000	7	1975*		818.0	-	-	-	James Bay
					1976*		1 510.0	-	-	-	
					1977*		450.0	-	-	-	
					1980*		146.0	-	-	-	
					1981*		79.0	-	-	-	
					1982*		784.0	-	-	-	
					1983*		275.0	-	-	-	
						Mean:	580.3	-	-	-	
					Standard Deviation:		502.1	-	-	-	

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ARCTIC DRAINAGE - WATER SURVEY OF CANADA DATA
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Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/l)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
54	QUE	Broadback River above Lac Evans (03BD001)	10 900		1972*			-			Rupert Bay
55	NWT	Caledonian River above Bracebridge Inlet (10ICD08)	246	1	1975*		-	-	-	-	Bracebridge Inlet
56	MAN	Churchill River above Leaf Rapids (06EB004)	242 000	1	1978*	-	1 280.0		-	-	Hudson Bay
57	NWT	Cunningham River above Cunningham Inlet (10TD005)	1 810	1	1975*		-	-	-	-	Cunningham Inlet
58	ONT	Ekwan River below North Washagami River (04EA001)	10 400	1	1983*		35.0		-	-	James Bay
59	NWT	Eleanor River above Eleanor Lake (10TC015)	666	1	1975*		-		-	-	Wellington Channel
60	NWT	Falls River near d'Iberville Fiord (10IC002)	32.6	1	1975*				-	-	Greely Fiord
61	YUK	Firth River near the mouth (10MD001)	5 710	3	1972* 1973* 1974*		132.0 78.0 47.0		-	-	Beaufort Sea
						Mean: Standard Deviation:	85.7 43.0				
62	QUE	La Grande Rivière de la Baleine près de l'Embouchure (03FD002)	21 000	1	1973*						Hudson Bay

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63	ONT	Halfway Creek at Moosonee (04KA002)	133	6	1978	10	1.2	1	95	0.7	Moose River (James Bay)
					1979	48	1.3	22	899	6.8	
					1980	37	1.2	13	494	3.7	
					1981	28	0.7	48	1 056	7.9	
					1982	20	1.5	39	1 792	13.5	
					1983	10	1.1	141	4 765	35.8	
						Mean:	1.2	45	1 517	11.4	
					Standard Deviation:		0.3	50	1 690	12.7	
64	QUE	Harricana (Rivière) à Amos (04NA001)	3 680	9	1968-76*						Hannah Bay
65	ONT	Kwataboahegan River Near the Mouth (04KA001)	4 250	1	1983*		83.9				Moose River (James Bay)
66	NWT	Lang River above Prince Regent Inlet (10ID001)	134	1	1975*						Prince Regent Inlet
67	NWT	Lord Lindsay River above Sanagak Lake (10SA002)	1 440	1	1975*						Thom Bay
68	NWT	Mackenzie River above Arctic Red River (10LA003)	1 660 000	9	1972*		13 300.0				Beaufort Sea
					1973	23	17 720.0	284	51 669 600	31.1	
					1974	13	19 300.0	898	182 277 300	110.1	
					1975*		15 500.0				
					1980	33	12 500.0	269	35 524 500	21.4	
					1981	43	12 500.0	178	35 307 800	21.3	
					1982	46	14 000.0	294	54 388 000	32.8	
					1983	37	12 400.0	211	35 452 500	21.4	
					1984	67	14 100.0	423	94 994 100	57.2	
						Mean:	14 533.0	366	69 937 686	42.2	
					Standard Deviation:		2 386.0	247	53 878 464	32.5	

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Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
69	NWT	Mackenzie River (Aklavik Channel) above Schooner Channel (10MC005)		2	1974	10	627.0	461	3 816 860		Beaufort Sea
					1975*		679.0				
						Mean:	653.0	461	3 816 860		
					Standard Deviation:		36.8				
70	NWT	Mackenzie River (East Channel) at Inuvik (10LC002)		3	1974	17	370.0	441	1 718 906		Beaufort Sea
					1975	25	271.0	273	981 032		
					1977*		253.0				
						Mean:	298.0	357	1 349 564		
					Standard Deviation:		63.0	119	521 182		
71	NWT	Mackenzie River (Kalinek Channel) above Oniak Channel (10LC006)		2	1974	8	652.0	555	2 878 629		Beaufort Sea
					1975*		541.0				
						Mean:	596.5	555	2 878 629		
					Standard Deviation:		78.5				
72	NWT	Mackenzie River (Middle Channel) Napoiak Channel (10LC008)		2	1974	8	16 800.0	851	113 629 900		Beaufort Sea
					1975*		15 100.0				
						Mean:	15 950.0	851	113 629 900		
					Standard Deviation:		1 202.1				
73	NWT	Mackenzie River (Peel Channel) above Aklavik (10MC003)		2	1974	9	1 140.0	383	4 601 000		Beaufort Sea
					1975*	0	1 080.0				
						Mean:	1 110.0	383	4 601 000		
					Standard Deviation:		42.4				
74	NWT	Mackenzie River (West Channel) below Aklavik Channel (10MC004)		2	1974	7	1 650.0	364	4 780 390		Beaufort Sea
					1975*	0	1 910.0				
						Mean:	1 780.0	364	4 780 390		
					Standard Deviation:		183.8				

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ARCTIC DRAINAGE WATER SURVEY OF CANADA DATA
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Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
75	NWT	Marshall River above Assistance Bay (10ICO13)	109	1	1975*	-	-	-	-	-	Barrow Strait
76	ONT	Moose River at Moose River (04LG002)	60 100	7	1975		2 270.0				James Bay
					1976		349.0				
					1977		1 700.0				
					1978		1 070.0				
					1979		2 680.0				
					1980		1 150.0				
					1981		1 340.0				
					Mean:		1 508.4				
					Standard Deviation:		783.4				
77	MAN	Nelson River above Bladder Rapids (05UD004)	1 000 000	1	1978*	-	-	-	-	-	Hudson Bay
78	ONT	North French River near the mouth (04MF001)	6 680	1	1983*		199.0				Moose River (James Bay)
79	QUE	Nottaway River at the Head of Soscumica Lake (03AD001)	57 500	1	1972*	-	-	-	-	-	Rupert Bay
80	QUE	Rupert River at Chipastouc Channel (03BB002)	10 100	1	1973*	-	-	-	-	-	Rupert Bay
81	ONT	Severn River at Limestone River (04CC001)	94 300	3	1975*		2 000.0				Hudson Bay
					1978*		896.0				
					1979*		790.0				
					Mean:		1 228.6				
					Standard Deviation:		670.1				

* Miscellaneous Data Only

ARCTIC DRAINAGE WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/l)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
82	NWT	Snowblind Creek above Laura Lakes (10TC014)	347	1	1975*						Wellington Channel
83	NWT	Unnamed Eastern Tributary of Wrottesley River (10SA004)	603	1	1975*						Wrottesley Inlet
84	NWT	Unnamed River above Allison Inlet (10TC010)	293	1	1975*						Allison Inlet
85	NWT	Unnamed River above Bracebridge Inlet (10TC011)	510	1	1975*						Bracebridge Inlet
86	NWT	Unnamed River above Goodsir Inlet (10TC009)	580	1	1975*						Goodsir Inlet
87	NWT	Unnamed River above King Point (10TC004)	1 120	1	1975*						Byam Channel
88	NWT	Unnamed River above Sabine Bay (10TC006)	1 340	1	1975*						Sabine Bay
89	NWT	Unnamed River above Warren Point (10TC007)	193	1	1975*						Sherard Bay
90	NWT	Unnamed River above West Arm of Weatherall Bay (10TC005)	298	1	1975*						Weatherall Bay

* Miscellaneous Data Only

ARCTIC DRAINAGE - WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/l)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
91	NWT	Unnamed River at Outlet of Lake Jekyl (105A001)	502	1	1975*	-	-	-	-	-	Thom Bay
92	NWT	Unnamed River near Cape Gell (101C017)	94.3	1	1975*	-	-	-	-	-	Maury Channel
93	NWT	Unnamed River near Schomberg Point (101C012)	97.9	1	1975*	-	-	-	-	-	Austin Channel
94	NWT	West Creswell River above Creswell Bay (101D003)	505	1	1975*	-	-	-	-	-	Creswell Bay
95	ONT	Winisk River below Ashewelg River Tributary (04DC001)	50 000	2	1979* 1980*	- -	501.0 643.0	- -	- -	- -	Hudson Bay
						Mean:	572.0	-	-	-	
						Standard Deviation:	100.4	-	-	-	

* Miscellaneous Data Only

ARCTIC DRAINAGE - SPECIFIC STUDIES

Map #	Province	Reference	River	Study Year	Suspended Sediment Concentration (mg/l)	Bedload (tonnes)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
96	Québec	d'Anglejan (1982)	Eastmain River	1976	6-250		1 200 000 93-50 600 t/day		Eastmain Estuary
97	NWT	Ballantyne (1975)	Schei River	1974			10 251		Vendom Fiord
98	NWT	Brunskill et al. (1973)	Mackenzie River at Norman Wells	1971			740 2 100 000		Beaufort Sea
99	NWT	Church (1972)	Ekalugad Fiord:						Home Bay
			North Section	1967			21 659	115	
			Upper N. Section	1967			16 325		
			Middle Section	1967		60 347	3 852	39	
			Upper M. Section	1967			6 934		
			South Section	1967		34 487	3 523	49	
			Upper S. Section	1967		100 041	4 378		
			South Section	1968		66	239	1	
			Upper S. Section	1968		2 577	72		
100	Yukon	Forbes (1981)	Babbage River	1974		60	138		Beaufort Sea
			below Tulugaq R.	1975		79	245		
				1976		67	173		
101	Québec	Frenette (1977)	Nottaway, Rupert & Broadback Rivers	1977			0.8 0.9x10^6		Rupert Bay
102	Québec	Frenette (1979)	Nottaway River	1978		40 000	403 460		Rupert Bay
			Broadback River	1978		15 000	148 530		
			Rupert River	1978		100 000	236 595		
103	NWT	Gilbert (1978)	Overlord River	1977	>2 000				Pangnirtung Fiord
			Weasel River		>2 000				

ARCTIC DRAINAGE - SPECIFIC STUDIES

Map #	Province	Reference	River	Study Year	Suspended Sediment Concentration (mg/l)	Bedload (tonnes)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
104	Ontario	King (1980)	Attawapiskat R.		14 (Mean)				James Bay
105	Québec	Legendre and d'Anglejan (1977)	Nottaway, Rupert & Broadback Rivers	1977			2 200 000		Rupert Bay
106	Yukon	Lewis and Forbes (1974)	Babbage River Deep Creek	1974 1974	10 100				Beaufort Sea
107	Yukon	McDonald and Lewis (1973)	Blow River	1972	0.4 823				Beaufort Sea
108	NWT	McLaren (1981)	Consett Head R.	1974			70 800		Byam Channel
109	NWT	Ostrem et al. (1967)	Decade River	1967			30 t/day 1 972 t/yr		Inugsuin Fiord
110	Québec	St. Pierre and Messier (1983)	Eastmain and Opinaca Rivers	1979 1980			144 000		St. Lawrence R.
111	NWT	Wedel et al. (1977)	Snowbird Creek	1976		153	1 560		Graham Moore Bay

PACIFIC DRAINAGE WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
112	BC	Carnation Creek at the mouth (08HB048)	10.1	11	1973	160	0.739	13	258	25.6	Barkley Sound
					1974	200	1.110	8	277	27.4	
					1975	168	1.050	9	282	27.9	
					1976	188	0.746	5	117	11.6	
					1977	226	0.726	6	146	14.4	
					1978	141	0.553	12	216	21.4	
					1979	275	0.669	9	198	19.6	
					1980	142	0.846	10	275	27.2	
					1981	299	0.834	5	124	12.3	
					1982	245	0.878	9	250	24.7	
					1983	311	0.975	8	239	23.7	
						Mean:	0.830	9	216	21.4	
					Standard Deviation:		0.167	3	62	6.1	
113	BC	Fraser River at Mission (08MH024)	228 000	19	1965	163	4 100	167	12 642 561	55.4	Strait of Georgia
					1966	248	3 680	166	19 271 264	84.5	
					1967	214	3 900	212	26 070 506	114.0	
					1968	220	4 020	165	20 927 421	91.8	
					1969	188	3 380	131	13 926 210	61.1	
					1970	157	2 590	141	11 496 691	50.4	
					1971	187	3 420	163	17 530 618	76.9	
					1972	176	4 030	243	30 949 629	136.0	
					1973	175	3 010	129	12 217 675	53.6	
					1974	172	3 870	204	24 940 879	109.0	
					1975	182	3 290	115	11 976 281	52.5	
					1976	185	4 200	187	24 879 122	109.0	
					1977	229	3 080	150	14 534 748	63.7	
					1978	164	2 940	133	12 295 063	53.9	
					1979	144	2 790	171	15 009 656	65.8	
					1980	107	3 040	114	10 908 337	47.8	
					1981	149	3 370	116	12 368 962	54.2	
					1982	155	3 670	221	25 563 498	112.0	
					1983	134	3 250	79	8 093 451	35.5	
						Mean:	3 454	158	17 136 977	75.1	
					Standard Deviation:		479	42	6 552 070	28.7	
114	BC	Homathko River at the mouth (08GD004)	5 720	2	1982*		-	-	-	-	Bute Inlet
					1983	18	360	408	2 718 472	475.0	

* Miscellaneous Data Only

PACIFIC DRAINAGE - WATER SURVEY OF CANADA DATA
(Suspended Sediment Data Only)

Map #	Prov.	Station Name & Number	Drainage Area (km^2)	Years of Record	Year	Number of days Sampled	Mean Discharge (m^3/s)	Mean Concentration (mg/L)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
115	BC	Iskut River below Johnson River (08CG001)	9 350	2	1982 1983*	95	656	493	5 977 251	639.0	Stikine River (Frederick Sound)
116	BC	Squamish River below Mamquam River (08GA053)		3	1973-75*						Howe Sound
117	BC	Stikine River above Butterfly Creek (08CF001)	36 000	2	1982 1983*	81	1 090.0 1 040.0	494	8 525 866	237.0	Frederick Sound
						Mean:	1 065.0				
						Standard Deviation:	35.4				

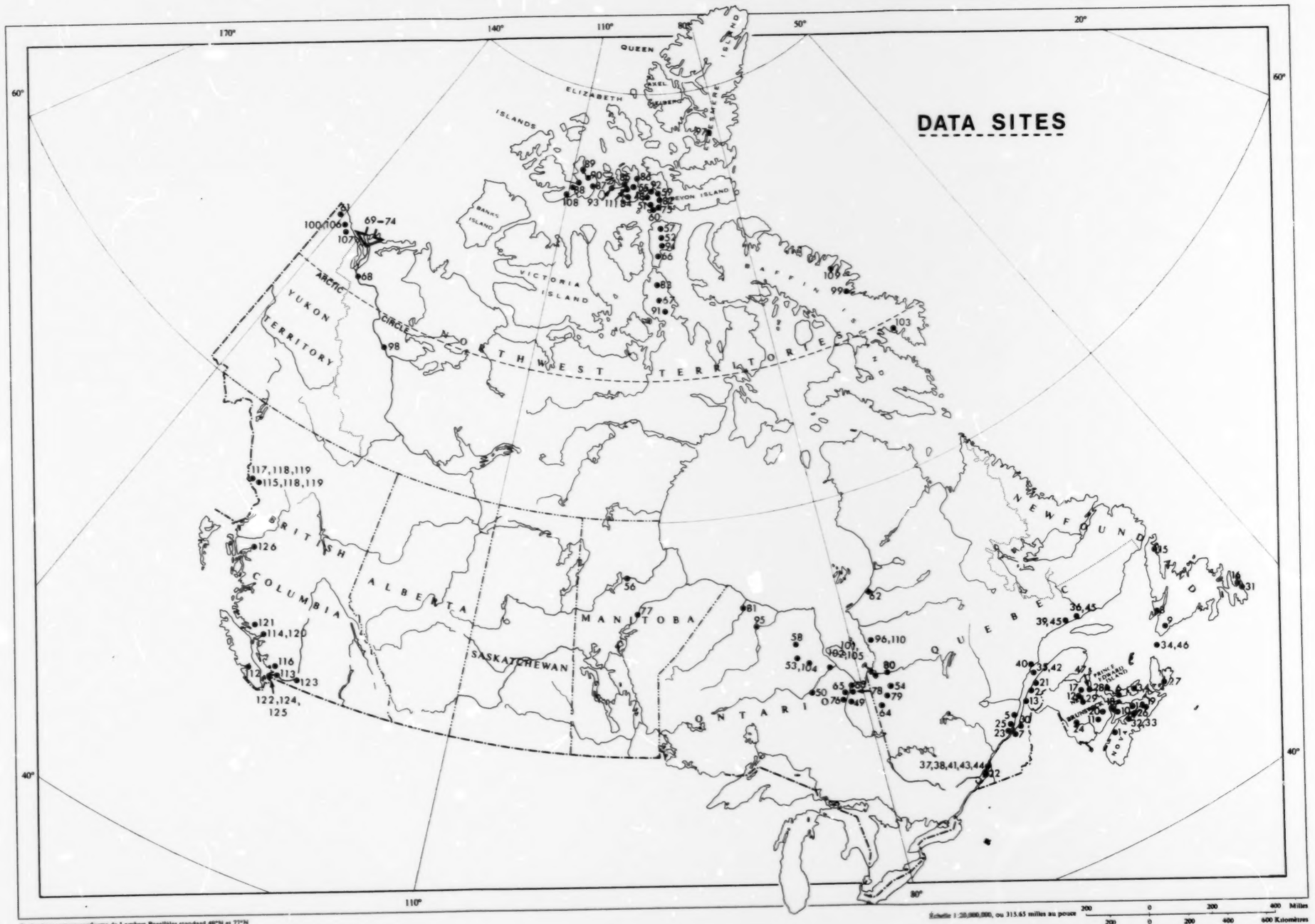
PACIFIC DRAINAGE - SPECIFIC STUDIES

Map #	Province	Reference	River	Study Year	Suspended Sediment Concentration (mg/L)	Bedload (tonnes)	Total Load (tonnes)	Basin Yield (tonnes/km^2)	Flows Into
118	British Columbia	B.C. Hydro (1981)	Iskut River below Johnson River	1978			4 885 000	522	
							8 562 000*	916	Stikine River
				1979			4 261 000	456	
							6 364 000*	681	
			Stikine River above Butterfly Creek	1978			2 265 000	242	
							2 435 000*	260	Frederick Sound
				1979			5 945 000	636	
							6 355 000	680	
119	British Columbia	B.C. Hydro (1982)	Iskut River below Johnson River	1978			7 053 000*	754	
				1979			5 443 000*	582	Stikine River
				1980			8 838 000*	945	
				1981			11 774 000*	1 259	
			Stikine River above Butterfly Creek	1978			2 413 000*	258	
				1979			5 294 000*	566	Frederick Sound
				1980			8 312 000*	889	
				1981			8 315 000*	889	
120	British Columbia	B.C. Hydro (1984)	Homathko River at the Mouth	1982			4 369 000	749	Bute Inlet
				1983			2 745 000	741	
121	British Columbia	Farrow et al. (1983)	Klinaklini River	1981			4 730 000		Knight Inlet
122	British Columbia	Johnston (1921)	Fraser River at New Westminster	1919	20-210				Strait of Georgia
				1920	10-230				
123	British Columbia	Kidd (1953)	Fraser River at Hope	1949-1952			18 500 000	85	Strait of Georgia
124	British Columbia	Langley (1971)	Fraser River at Vancouver	1971		Graph in text			Strait of Georgia
125	British Columbia	Langley (1973)	Fraser River at Vancouver	1972		Graph in text			Strait of Georgia
126	British Columbia	MacDonald (1983)	Kitimat River	1982	5-15				Kitimat Fiord

* Estimated

APPENDIX 2

MAP OF DATA SITES



Projection conique conforme de Lambert Parallèles standard 49°N et 77°N

Échelle 1:20,000,000, ou 315.65 milles au pouce

200 0 200 400 Milles

200 0 200 400 600 Kilomètres

ATLAS NATIONAL DU CANADA